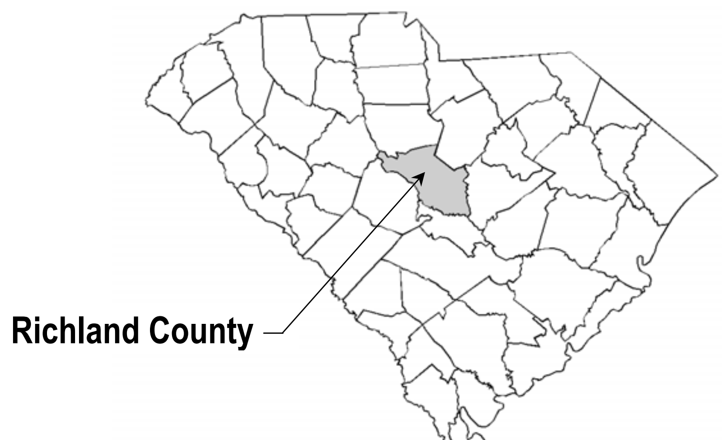
FLOOD INSURANCE STUDY

VOLUME 1 OF 2

RICHLAND COUNTY, SOUTH CAROLINA
AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER
ARCADIA LAKES, TOWN OF	450171
COLUMBIA, CITY OF	450172
EASTOVER, TOWN OF	450173
FOREST ACRES, CITY OF	450174
IRMO, TOWN OF	450133
UNINCORPORATED AREAS	450170



PROOF
AUGUST 20, 2001

REVISED:

Federal Emergency Management Agency

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

Part or all of this FIS may be revised and republished at any time. In addition, part of this FIS may be revised by the Letter of Map Revision process, which does not involve republication or redistribution of the FIS. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current FIS components.

Initial Countywide FIS Effective Date: January 19, 1994

Revised FIS Date: July 17, 1995

This preliminary FIS report does not include unrevised Floodway Data Tables or unrevised Flood Profiles. These Floodway Data Tables and Flood Profiles will appear in the final FIS report.

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FLOOD INSURANCE STUDY
RICHLAND COUNTY, SOUTH CAROLINA, AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This countywide Flood Insurance Study (FIS) revises and updates the previous countywide FIS/Flood Insurance Rate Map (FIRM) for the geographic area of Richland County, South Carolina, including: the Towns of Arcadia Lakes, Eastover, and Irmo; the Cities of Columbia and Forest Acres; and the unincorporated areas of Richland County (hereinafter referred to collectively as Richland County). The Town of Blythewood is non-floodprone. The Town of Irmo and the City of Columbia are located in more than one county. The FIS and FIRM for Richland County will show the portions of the Town of Irmo and the City of Columbia within Richland County. The remaining portions of these communities lie within Lexington County. The flood hazard information for the portions of the Town of Irmo and the City of Columbia that are located in Lexington County is included in the FIS for Lexington County, South Carolina, and Incorporated Areas (Reference 1).

This FIS aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This FIS has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates. This information will also be used by Richland County to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP), and by local and regional planners to further promote sound land use and floodplain development. Minimum floodplain management requirements for participation in the NFIP are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this FIS are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The original January 19, 1994, countywide FIS was prepared to include incorporated communities within Richland County into a countywide FIS. Information on the authority and acknowledgments for each jurisdiction was compiled from their previously printed FIS reports, and is shown below.

Town of Arcadia Lakes: the hydrologic and hydraulic analyses for the study dated May 1980 (FIRM dated November 19, 1980) were prepared by the U.S. Army Corps of Engineers (USACE), Charleston District, for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. IAA-H-10-77, Project Order No. 5. Field surveys were performed by Triangle Engineering-Architecture Planning, Inc., under supervision of the USACE. That work was completed in May 1979.

City of Columbia: the hydrologic and hydraulic analyses for the study effective September 1, 1983, were prepared by the USACE, Charleston District for FEMA, under Inter-Agency Agreement No. IAA-H-10-77, Project Order No. 5. Field surveys were performed by Heaner-Engineering Company, Inc., and Triangle Engineering-Architecture Planning, Inc., under supervision of the USACE. Field inspections for the study effective February 4, 1987, were performed by the USACE, Charleston District, for FEMA.

Town of Eastover: the hydrologic and hydraulic analyses for the study effective September 30, 1988, were prepared by the U. S. Geological Survey (USGS), Water Resources Division, for FEMA, under Inter-Agency Agreement No. EMW-85-E-1823, Project Order No. 10. That work was completed in May 1986.

City of Forest Acres: the hydrologic and hydraulic analyses for the study effective March 25, 1983, were prepared by the USACE, Charleston District, for FEMA, under Inter-Agency Agreement No. IAA-H-10-77, Project Order No. 5. Field surveys were performed by Heaner Engineering Company, Inc., and Triangle Engineering-Architecture Planning, Inc., under supervision of the USACE. That work was completed in April 1979. The hydrologic and hydraulic analyses for the study effective November 20, 1991, were prepared for FEMA by Mr. Stephen Bradley, P.E., for Gills Creek, and the USACE, Charleston District, for Eightmile Creek.

Town of Irmo: the hydrologic and hydraulic analyses for the study effective January 3, 1985, were performed by the USACE, Charleston District, for the FIA, under Inter-Agency Agreement No. IAA-H-10-77, Project Order No. 5. Field surveys for that study were performed by Heaner Engineering Company, Inc., under supervision of the USACE. That work was completed in August 1978. For the study effective April 16, 1991, the hydrologic and hydraulic analyses were performed by Mr. Steven M. Bradley, P.E.

Richland County (Unincorporated Areas): the hydrologic and hydraulic analyses for the study effective November 4, 1981, were prepared by the USACE, Charleston District, for FEMA, under Inter-Agency Agreement No. IAA-H-10-77, Project Order No. 5. Field surveys were performed by Heaner Engineering Company, Inc., and Triangle Engineering-Architecture Planning, Inc., under supervision of the USACE. The hydraulic analysis for the study effective January 3, 1985, was prepared by the USACE, Charleston District, for FEMA. The hydrologic and hydraulic analyses for the study effective April 17, 1987, were prepared by the USACE, Charleston District, for FEMA. The hydraulic analysis for the study effective December 5, 1989, was prepared by the USACE, Charleston District, for FEMA.

For the January 19, 1994, FIS, the hydrologic and hydraulic analyses for the unincorporated areas of Richland County and the City of Columbia were prepared by the USACE, Charleston District, for FEMA, under Inter-Agency Agreement No. EMW-87-E-2509, Project Order No. 8. That work was completed in February 1989.

In the July 17, 1995, revision, the community disclaimer note for the Town of Irmo was removed. The town is now included in this FIS.

For this revision, the hydrologic and hydraulic analyses for the Congaree River were prepared by Hayes, Seay, Mattern & Mattern, Inc. (under Contract No. EMW-95-C-4723). This work was completed in August 1996. The hydrologic and hydraulic analyses for Spears Creek were prepared by Braswell Engineering, Inc., under Contract No. EMA-96-CO-0021. This work was completed in February 1998. Dewberry & Davis LLC and Lockwood Greene Engineers, Inc., also provided hydrologic and hydraulic analyses for the Congaree River.

1.3 Coordination

An initial Consultation Coordination Officer's (CCO) meeting is held with representatives from FEMA, the community, and the study contractor to explain the nature and purpose of a FIS, and to identify the streams to be studied by detailed methods. A final CCO meeting is held with representatives from FEMA, the community, and the study contractor to review the results of the study.

The dates of the initial and final CCO meetings held for Richland County and the incorporated communities within its boundaries are shown in the following tabulation:

Community Name	Initial CCO Date	Final CCO Date
Town of Arcadia Lakes	January 1976	November 14, 1979
City of Columbia	January 1976	August 28, 1980
Town of Eastover	January 30, 1985	August 20, 1987
City of Forest Acres	January 1976	November 14, 1979
Town of Irmo	January 1976	April 25, 1979
Richland County (Unincorporated Areas)	January 1976	August 28, 1980

On January 30, 1992, a final CCO meeting was held with representatives of Richland County, the Towns of Arcadia Lakes and Eastover, and the City of Forest Acres, in order to review the results of the January 19, 1994, countywide study. On January 20, 1992, a final CCO meeting was held with representatives of the City of Columbia.

For this revision, an initial CCO meeting was held on March 26, 1998, and was attended by representatives of the Richland County Planning Commission, Hayes, Seay, Mattern & Mattern, Inc., and FEMA.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Richland County, South Carolina. The area of study is shown on the Vicinity Map (Figure 1).

All or portions of the following flooding sources were studied by detailed methods: the Congaree River, Mill Creek, Tributary MC-1, Reeder Point Branch, Gills Creek, Tributary G-1, Eightmile Branch, Jackson Creek, Little Jackson Creek, Lightwood Knot Branch, Tributary LJ-1, Rocky Branch, the Broad River, Stoop Creek, Nicholas Creek, Swygert Branch, Moccasin Branch, North Branch Crane Creek, Beasley Creek, Cumbess Creek, Roberts Branch, Tributary RB-1, Sorghum Branch, Spears Creek, Tributary SP-1, Sandy Branch, Bridge Creek, Rice Creek, and Tributary RP-1, Smith Branch, Crane Creek, Tributary C-2, Tributary C-5, Tributary C-5-1, the Saluda River, Wildcat Creek, Pen Branch, Tributary E-1, Bay Branch, Griffins Creek, Orphanage Branch, Rawls Creek, and Tributary R-2.

For the January 19, 1994, FIS, Stoop Creek, Smith Branch, Bay Branch, and Reeder Point Branch were completely restudied. Crane Creek was partially restudied upstream of U. S. Route 321. The following streams were newly studied by detailed methods: Nicholas Creek, Swygert Branch, Moccasin Branch, North Branch Crane Creek, Beasley Creek, Cumbess Creek, Roberts Branch, Tributary RB-1, Sorghum Branch, Spears Creek, Tributary SP-1, Sandy Branch, Bridge Creek, Rice Creek, and Tributary RP-1.

The January 19, 1994, FIS incorporated the effects of annexations of land by the Cities of Columbia and Forest Acres and the Town of Arcadia Lakes. The January 19, 1994, FIS also incorporated the determinations of four Letters of Map Revision (LOMRs) issued by FEMA for the following projects, with the affected community and date in parentheses: revision of the Special Flood Hazard Area (SFHA) for an unnamed tributary to Little Jackson Creek (unincorporated areas of Richland County - March 9, 1984); revision of the SFHA for an unnamed tributary to Little Jackson Creek based on grading improvements and a new drainage channel (unincorporated areas of Richland County - April 10, 1987); Pen Branch (City of Forest Acres - February 27, 1992); and modifications to the base flood elevations, the SFHA, and the floodway along Gills Creek (City of Columbia - May 24, 1990).

For this revision, the Congaree River was restudied for its entire length within the county. Spears Creek was restudied from Mill Pond Road to the upstream study limit, for a total distance of 3.6 miles. This revision also incorporates the LOMR dated June 9, 1995, which reflected the following changes: modifications to the base flood elevations, the SFHA, and the floodway along portions of Boyd, Metz, and Wildhorse Branches, and Hollingshed Creek; fill placement along Hollingshed Creek and Boyd Branch; a new arch culvert at the Hollingshed Creek Boulevard crossing of Hollingshed Creek.

Limits of detailed study are indicated on the Flood Profiles (Exhibit 1) and on the FIRM (Exhibit 2). The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction.

Numerous flooding sources in the county were studied by approximate methods. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and Richland County.

2.2 Community Description

Richland County is located in the central portion of South Carolina. The total land area within the county limits is 748 square miles. According to U. S. Census Bureau figures, the population has increased from 233,868 in 1970 to 292,601 in 1996.

The eastern boundary of Richland County is formed by the Wateree River. The Congaree River forms the southern county limits and the southwestern boundary. The Saluda River forms the northwestern county boundary. The Broad and Saluda Rivers come together at Columbia to form the Congaree River; the Congaree and Wateree Rivers join at the southeastern corner of Richland County to form the Santee River. Gills Creek, Mill Creek, and Reeder Point Branch are tributaries of the Congaree River and flow from the Fort Jackson Military Base in a southerly or southwesterly direction. Tributaries on the northeast side of the Broad River, including Crane Creek and Smith Branch, originate in the northeastern quadrant of the county and flow southwesterly. On the southwest side of the Broad River, several small tributaries originate on the north side of U. S. Highway 76 and flow easterly. Wateree River tributaries include Colonels Creek which flows southeasterly from Fort Jackson, and several streams which originate in the northeast corner of the county and flow southeasterly.

Most of the urbanized area of Richland County is located on the west side of the county in the vicinity of Columbia, Arcadia Lakes, Forest Acres and the Fort Jackson cantonment area. Except for a few other small urban areas in the vicinity of Blythewood, near the northern county boundary, and the Town of Eastover, near the Wateree River, the land is wooded or used for agricultural purposes. The floodplains of several Richland County streams contain residential and commercial development. The most significant flood hazard areas are located along Jackson Creek, Little Jackson Creek, Gills Creek, Rocky Branch, Smith Branch, and Crane Creek. Along most of the other Richland County streams the floodplains are wooded or used for agricultural purposes.

Soils in Richland County are generally excessively drained silty sands and loams with local deposits of rock and gravels. In the creek bottoms, soils generally consist of alluvial sands and silt blanketed with finer (clay) soils with local deposits of sands and gravels.

The climate of central South Carolina is temperate. Average monthly temperatures range from 84 degrees Fahrenheit (^{o}F) in the summer to 39^{o}F in the winter. Average annual precipitation for the region is 46 inches. The precipitation is fairly evenly distributed throughout the year, but approximately forty percent of the annual rainfall can be expected to occur during the period of June through October (Reference 2).

2.3 Principal Flood Problems

The past history of flooding on the streams in Richland County indicates that flooding may occur during any season of the year. However, floods on the larger streams, the Broad, Congaree, and Wateree Rivers, are more likely to occur from June through October as a result of tropical hurricanes.

Flood records for the Congaree River, Broad River, and Gills Creek were available in the USGS Water Supply Paper 1673 (Reference 3). The three worst floods on the Congaree and Broad Rivers occurred in August 1908, August 1928 and October 1929. Peak discharges for these events at the Congaree River gage below Gervais Street at Columbia were 364,000 cubic feet per second (cfs), 311,000 cfs and 303,000 cfs, respectively.

The maximum stage recorded on the Congaree River at the Gervais Street gage was 152.8 feet, National Geodetic Vertical Datum of 1929 (NGVD). The 100-year flood under existing conditions would reach an elevation of 155.8 feet NGVD at the gage.

Principal flood problems along Reeder Point Branch and Mill Creek are generally on the upstream side of railroad embankments for the CSX Transportation and Southern Railway. Although there is little development in the floodplain at present, development which is under construction, or planned for construction, could be subject to fairly deep flooding.

The flood problems along Gills Creek are compounded by a number of large and small lakes formed by dams across Gills Creek and two tributary streams, Jackson Creek and Little Jackson Creek. In the past some of these dams have failed and others have been purposely breached to prevent failure. Results indicate that Lake Katherine Dam, Forest Lake Dam and several other dams upstream from Forest Lake would fail during floods of 50-year frequency or greater. Dam failures in the upper basin would increase peak flood discharges at Forest Lake and Lake Katherine, but results indicate that both dams would fail during floods of 50-year frequency or greater even if none of the upstream dams failed. Both Forest Lake Dam and the Lake Katherine Dam failed during major floods in the 1940's and were rebuilt or repaired under military supervision. At the time these events occurred, there was very little development in the downstream floodplain. A major flood under existing conditions would overtop Forest Lake Dam and Lake Katherine Dam. The high water velocities would erode the downstream faces of both dams, causing them to fail. The combined effect of deep flooding and high-water velocities would result in extensive damage to homes, commercial structures and other facilities between Forest Lake and Garners Ferry Road.

Along Bay Branch between Sunset Drive and the Columbia corporate limits, several residential structures are located dangerously close to the stream. During major floods, some of these structures will be subjected to deep flooding and high water velocities. Smith Branch, Eightmile Branch and the other streams studied in detail are capable of reaching developed property at various locations, and during major floods, they could cause significant damage.

Flood problems along Jackson Creek and Little Jackson Creek are located primarily along those portions which are downstream of dams which would fail during major floods. Spring Lake Dam, Arcadia Lake Dam, Windsor Lake Dam, Pine Lake Dam, and Parliment Lake Dam are located on Jackson Creek and would fail during a major flood. Springwood Lake Dam on Little Jackson Creek could also be expected to fail during a major flood. Development immediately downstream from these dams ranges from intense commercial development downstream of Springwood Lake, to residential areas downstream of the other lakes.

Along Stoop Creek the flood situation is compounded by several bridges with inadequate flow openings, and by development located dangerously close to the stream channel. Several apartment complexes are located along this stream, and the stream has been channelized through some of the complexes.

The floodplains along Crane Creek, Smith Branch, and the three tributaries to Crane Creek are mostly undeveloped at this time. However, development in the area is expected and floodplain management information is needed to prevent unwise use of the floodplains.

There is no information available about past floods for the flooding sources in the Town of Irmo. Because the drainage areas are small and there is a considerable amount of urban development in the basins, it is reasonable to assume that floods can occur at any time during the year from thunderstorms.

2.4 Flood Protection Measures

There are presently no completed projects designed to reduce flooding on any of the streams studied in detail.

Floods in the study area may be affected by operation of two large reservoirs on the Saluda River. Lake Greenwood, formed by Buzzards Roost Dam, which was completed in 1940, is operated by Duke Power Company. Lake Greenwood, located at river mile 60 has a surface area of approximately 11,400 acres at maximum power pool. Saluda Dam, completed in 1930 by South Carolina Electric and Gas Company, forms Lake Murray and is located about 12 miles above the mouth of the Saluda River. It has a surface area of approximately 51,000 acres at maximum power pool.

Both reservoirs are operated for hydropower generation and are subject to regulations prescribed by the Federal Energy Regulatory Commission (FERC). Both of these dams are operated to produce hydroelectric power.

A levee exists along the east bank of the Congaree River that provides the county with some degree of protection against flooding. The criteria used to evaluate protection against the 100-year flood are 1) adequate design, including freeboard, 2) structural stability, and 3) proper operation and maintenance. FEMA specifies that all levees must meet the criteria of NFIP regulations Section 65.10 to be considered a safe flood protection structure. It has been determined that the levee along the Congaree River does not meet these requirements. Therefore, since the levee does not meet all of the requirements, the levee cannot be certified as providing protection against the 100-year flood.

Non-structural measures of flood protection have been implemented by Richland County to aid in the prevention of future flood damage. These are in the form of subdivision regulations which control construction within flood hazard areas (Reference 4).

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the county.

Precountywide Analyses

Each community within Richland County had a previously printed FIS report describing that community's hydrologic analyses. Those analyses not revised in the January 19, 1994, countywide FIS have been compiled from the FIS reports and are summarized below.

For the unincorporated areas of Richland County and the City of Columbia, discharge-frequency relationships for the Congaree, Broad, and Saluda Rivers were derived using the log-Pearson Type III Method based on stream gage records collected at the USGS stream gaging stations listed below (References 5 and 6):

Station	Years of record
Saluda River near Columbia, South Carolina	52
Broad River near Richtex, South Carolina	52
Congaree River at Columbia, South Carolina	86

Records have been collected on the Congaree River at Columbia since 1891 and on the Saluda River near Columbia and the Broad River at Richtex since 1925. The construction of Saluda Dam in 1929 altered the flood situation at both gaging stations. Maximum operating pool level of Lake Murray, as regulated by the FERC is 360 feet NGVD. When inflow during major floods requires temporary storage above maximum operating pool level, releases are made through spillway gates to augment discharges through power turbines in order to lower the reservoir to required maximum pool level as soon as possible. During this operation, spillway gates are opened gradually until the lake level begins to recede. As long as the reservoir level continues to rise, gate openings will be increased until all six spillway gates are wide open. This type of operation attempts to keep outflow approximately equal to inflow without allowing the reservoir to rise to a dangerous level. If, prior to a flood occurrence, the reservoir happens to be below normal operating level, some of the flood water will be stored, resulting in a reduction of peak discharges downstream. The chance of incidental flood control storage is greater for minor floods than for major events; therefore, it was assumed that stream-flow records collected on the Saluda River near Columbia and the Congaree River at Columbia could be used, without adjustments, to determine discharge frequency relationships for floods up to 10-year frequency at both stations. In order to establish the upper end of the discharge-frequency curves, it was necessary to adjust recorded flood discharges which were affected by coincidental flood control storage. This was accomplished by applying methods based on the Hydrologic Equation utilizing peak discharge and mean discharge information supplied by the USGS and South Carolina Electric and Gas Company (Reference 7 and 8). The adjustments provided a homogenous set of data which was used as a basis for probability studies to establish the portion of the discharge-frequency curves from 50-year frequency at both stations. Smooth transitions were drawn between the upper and lower frequency curves for both stations.

Additional data used to confirm frequency curves developed by the methods described above included a Standard Project Flood developed for the Congaree River at Columbia (Reference 9); and a Standard Project Flood developed by the USACE, Savannah District, during the preparation of the detailed design memorandum for the Cooper River Rediversion Project (Reference 10). Discharge-frequency relationships for Gills Creek, Jackson Creek, Little Jackson Creek, Tributary LJ-1, Crane Creek, Mill Creek, and Tributary G-1 were developed using rainfall-runoff modeling techniques and flood routing techniques (References 11 and 12). Discharge-frequency relationships for Pen Branch, Bay Branch, Tributary E-1, Tributary MC-1, Reeder Point Branch, Eightmile Branch, Rocky Branch, Smith Branch, Stoop Creek, Lightwood Knot Branch, and Tributaries C-2, C-5, and C-5-1 were computed using the methods described in a USGS open file report published in 1972 (Reference 13). Results obtained using the empirical equation presented in the report have compared favorably with the results of probability studies and rainfall-runoff model studies on similar streams in the same area.

For the Town of Arcadia Lakes, discharge-frequency relationships for Jackson Creek were developed using rainfall-runoff modeling techniques and flood routing techniques (References 11 and 12). Discharge-frequency relationships for urbanized subbasins were also computed using methods described in a USGS open file report (Reference 13).

For the Town of Eastover, discharges for Griffins Creek were computed using equations developed for rural streams (Reference 14). Drainage areas were determined from topographic maps (Reference 15).

For the City of Forest Acres, discharge-frequency relationships for Gills Creek were developed using the rainfall-runoff modeling techniques and flood routing techniques (References 11 and 12). Discharge-frequency relationships for Pen Branch, Orphanage Branch, Eightmile Branch, and Tributary E-1 were computed using methods described in a USGS open file report published in 1972 (Reference 13).

For the Town of Irmo, discharge-frequency relationships for Rawls Creek and Tributary R-2 were developed using methods prescribed in the USGS open file report published in 1972 (Reference 13). Results obtained using the empirical equations presented in that report have compared favorably with the results of probability studies and rainfall runoff model studies on other streams in the same area.

For the portion of Rawls Creek upstream of the confluence of Tributary R-2, the undeveloped discharge of Rawls Creek at the upstream Town of Irmo corporate limits was estimated from regional regression equations (Reference 14). Adjustments to the discharges were made for future urbanization (References 13, 16, and 17).

Revised Analyses for the January 19, 1994, Countywide FIS

For the unincorporated areas of Richland County, the hydrologic analyses were performed using the USACE's HEC-1 computer program to establish peak discharge-frequency relationships for floods of the selected recurrence intervals for the following flooding sources (Reference 11): Stoop Creek, Nicholas Creek, Swygert Branch, Moccasin Branch, Crane Creek, North Branch Crane Creek, Beasley Creek, Cumbess Creek, Roberts Branch, Tributary RB-1, Sorghum Branch, Spears Creek, Tributary SP-1, Sandy Branch, Bridge Creek, and Rice Creek.

The discharges for the revised hydrologic analyses for Reeder Point Branch, Tributary RP-1, Smith Branch, and Bay Branch in the City of Columbia were developed from the hydrologic analyses from the FIS for the City of Columbia (Reference 18).

This Revision

The discharges for the Congaree River were developed by analyzing two major contributing watersheds: the Saluda River/Lake Murray watershed and the Broad River watershed. Peak flow records at USGS gaging station No. 02169500 for the Congaree River at Columbia, South Carolina, were analyzed following Bulletin 17B guidelines. These peak discharges were transposed south to the corporate boundary between Lexington County and Calhoun County (Reference 19). The Saluda Dam construction started in the fall of 1927, and was completed in 1930. The USGS gaging station No. 02169500 provides a uniform data set from water year 1931 to the present date. In water years 1928 and 1930, during construction of the Saluda Dam, two large floods occurred. In addition, there are records of annual maximum flows on the Broad River at Richtex (USGS gaging station No. 02161500) from 1925 on, occurring under uniform basin conditions. The peak flow records from these gages are also incorporated in the analysis. The flood discharges for Broad River and Saluda River have not been revised as part of this restudy.

A detailed HEC-1 hydrologic analysis for Spears Creek was updated by the USACE, Charleston District, to reflect existing field conditions as of February 1996, and was used to determine peak flows for the study site.

The Lake Murray stillwater elevation of 362.5 was computed using HEC-1.

A summary of the drainage area-peak discharge relationships for all of the streams studied by detailed methods is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs)			
		10-YEAR	50-YEAR	100-YEAR	500-YEAR
CONGAREE RIVER					
At downstream study limit, Lexington County line	8,109.0	151,300	247,300	298,400	442,700
At USGS gaging station No. 2169500	7,850.0	148,000	242,000	292,000	434,000
SALUDA RIVER					
At mouth	2,510.0	32,000	90,000	105,000	145,000
BROAD RIVER					
At mouth	5,340.0	135,000	245,000	298,000	485,000
MILL CREEK					
At Caughman Road	12.7	2,180	2,790	3,000	6,050
TRIBUTARY MC-1					
At mouth	3.3	1,660	2,530	2,870	4,020
GILLS CREEK					
At U. S. Routes 76 and 378	59.6	5,906	8,380	10,234	14,189
Above Lake Katherine Dam	53.8	5,714	8,436	10,599	15,277
Below Forest Lake Dam	44.5	5,714	8,467	10,320	14,460
Above Forest Lake Dam	44.5	5,167	8,303	9,711	13,363
TRIBUTARY G-1					
At Bluff Road	2.8	800	1,060	1,150	1,950

TABLE 1 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
EIGHTMILE BRANCH					
At mouth	4.0	1,960	2,920	3,290	4,560
At Covenant Road	2.1	1,380	2,120	2,420	3,330
At Two Notch Road	1.3	1,120	1,720	1,980	2,680
JACKSON CREEK					
Downstream of Carys Lake Dam	19.3	2,180	18,000	19,290	20,140
Upstream of Carys Lake Dam	19.3	3,000	6,750	7,310	12,230
At Carys Lake Headwaters	16.7	2,400	6,180	6,520	11,290
At Decker Boulevard	16.7	2,400	6,180	6,520	11,290
LITTLE JACKSON CREEK					
At Two Notch Road	7.7	1,630	5,090	5,300	5,780
At mouth	*	2,393	3,422	3,710	6,431
Just downstream of Seaboard Coast Line Railroad	*	1,938	2,754	3,001	5,232
At Springwood Lake Dam	*	1,477	2,090	2,294	4,023
Just downstream of Barbara Road	*	1,120	1,550	1,710	2,900
LIGHTWOOD KNOT BRANCH					
At mouth	1.5	1,080	1,700	1,970	2,730
TRIBUTARY LJ-1					
At Rabon Road	1.5	480	642	702	1,300
ROCKY BRANCH					
At mouth	3.7	2,210	3,190	3,550	4,780
At Southern Railway	2.9	2,110	3,020	3,360	4,430
TRIBUTARY C-2					
At mouth	2.5	1,500	2,300	2,700	3,700
Approximately 1,700 feet downstream of Pinner Road	1.9	1,250	2,000	2,350	3,300
TRIBUTARY C-5					
At mouth	4.9	2,400	3,400	3,900	5,100

*Data not available

TABLE 1 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
TRIBUTARY C-5-1					
At mouth	0.2	400	710	850	1,250
WILDCAT CREEK					
At mouth	5.6	660	1,020	1,160	2,190
PEN BRANCH					
At mouth	2.9	1,590	2,420	2,760	3,840
Downstream of confluence of Orphanage Branch	1.4	1,180	1,810	2,080	2,820
TRIBUTARY E-1					
At mouth	0.8	750	1,210	1,420	1,950
ORPHANAGE BRANCH					
At mouth	0.5	690	1,100	1,290	1,730
GRIFFINS CREEK					
At Town of Eastover southern corporate limits	7.05	*	*	490	*
Approximately 1,000 feet upstream of CSX Transportation	6.69	*	*	476	*
CRANE CREEK					
At mouth	56.33	7,594	13,362	16,419	21,919
Below confluence of North Branch Crane Creek	43.39	7,472	12,945	15,699	20,492
Above confluence of North Branch Crane Creek	21.88	3,696	6,940	8,697	11,696
Below confluence of Roberts Branch	17.63	3,175	6,111	7,645	10,186
Above confluence of Roberts Branch	11.39	2,676	4,554	5,481	7,125
Below confluence of Hospital Lake	8.88	2,408	3,998	4,784	6,123
Above confluence of Hospital Lake	8.88	3,076	4,562	5,319	6,660

*Data not available

TABLE 1 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
CRANE CREEK (continued)					
Below confluence of Sorghum Branch	4.54	1,337	2,023	2,395	3,086
Above confluence of Sorghum Branch	3.18	1,186	1,781	2,073	2,559
STOOP CREEK					
At mouth1	4.29	1,642	1,973	2,203	3,141
At Interstate Route 201	3.96	2,115	2,995	3,483	4,664
At Interstate Route 261	3.29	1,699	2,450	2,831	3,763
At Beatty Road	2.30	1,456	1,986	2,210	2,763
At Piney Grove Road	0.98	417	557	616	760
At dam	0.64	261	304	321	439
At Chinquapin Road	0.25	232	319	356	448
NICHOLAS CREEK					
At downstream limit of detailed study	7.39	1,752	2,699	3,180	4,014
Below confluence of Swygert Branch	6.25	3,270	4,739	5,549	6,950
Above confluence of Swygert Branch	4.86	2,665	3,821	4,482	5,591
Below confluence of Moccasin Branch	3.28	2,332	3,352	3,844	4,676
Above confluence of Moccasin Branch	2.11	1,316	1,925	2,218	2,716
SWYGERT BRANCH					
At mouth	1.39	620	940	1,097	1,396
MOCCASIN BRANCH					
At mouth	1.17	1,206	1,701	1,940	2,347
At Interstate Route 26	0.39	761	986	1,091	1,265
NORTH BRANCH CRANE CREEK					
Above confluence with Crane Creek	21.51	3,874	6,405	7,696	9,960
Below Lorick Road	16.11	3,410	5,524	6,623	8,478

[1]Outside Richland County

TABLE 1 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
BEASLEY CREEK					
At mouth	10.21	2,194	3,602	4,325	5,542
CUMBESS CREEK					
At Elizabeth Lake	2.62	1,111	1,661	1,929	2,883
At Powell Road	1.62	630	949	1,105	1,370
ROBERTS BRANCH					
At mouth	6.24	710	1,640	2,182	3,119
Below Stevensons Lake	5.73	705	1,698	2,278	3,137
Above Stevensons Lake	5.73	796	1,806	2,314	3,175
Below Crescent Lake	5.23	749	1,704	2,182	2,989
Above Crescent Lake	4.35	743	1,545	1,956	2,634
Below Epsworth Lake	3.55	626	1,303	1,659	2,233
Above Epsworth Lake	3.55	982	1,587	1,891	2,416
At Southern Railway	2.51	698	1,115	1,328	1,695
TRIBUTARY RB-1					
At Crescent Lake	0.88	392	619	732	926
SORGHUM BRANCH					
At mouth	1.36	466	658	749	903
SPEARS CREEK					
At County Line Dam	10.83	817	1521	1795	2320
Upstream of County Line Dam	10.83	1298	2025	2369	3004
Downstream of County Line Dam	7.14	456	701	804	1182
At Jacobs Mill Pond Dam	6.49	215	536	728	1108
Upstream of Jacobs Mill Pond Dam	6.49	1134	1722	1968	2433
At Lower Beaver Lake Dam	4.09	99	208	304	523
Upstream of Lower Beaver Lake Dam	4.09	363	663	801	1086
At Upper Beaver Lake Dam	3.69	213	402	490	666
Upstream of Upper Beaver Lake Dam	3.69	245	442	529	697
At Spears Creek Church Road Dam	2.84	64	82	88	95
Upstream of Spears Creek Church Road Dam	2.84	258	835	1126	1640

TABLE 1 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
SPEARS CREEK (continued)					
At Upper Most Dam at Jabat Drive	1.64	158	522	703	1037
TRIBUTARY SP-1					
At mouth	3.52	852	1,423	1,655	2,101
SANDY BRANCH					
Below Bridge Creek1	8.70	1,913	3,294	3,907	5,120
At Richland County boundary	4.00	1,319	2,299	2,707	3,512
BRIDGE CREEK					
At mouth	3.36	327	569	674	879
Below Kelly Mill Road Dam	2.23	170	282	387	588
Below Bridge Creek Dam	1.54	83	147	153	259
Below Legion Lake	0.81	258	611	732	969
RICE CREEK					
At mouth	14.10	1,313	2,167	2,600	3,409
At Lotts Mill Pond	13.68	1,264	2,094	2,520	3,323
At Hardcastle Road	8.40	312	628	788	1,093
Below Lake Columbia	6.41	253	488	609	852
Above Lake Columbia	6.41	994	1,839	2,294	3,053
At uppermost dam	1.54	341	600	721	935
REEDER POINT BRANCH					
At mouth	8.93	2,960	4,374	4,938	6,645
Below confluence of Tributary RP-1	6.74	2,445	3,683	4,218	5,663
Above confluence of Tributary RP-1	4.66	1,904	2,962	3,488	4,571
At Southern Railway	3.89	1,886	2,837	3,302	4,224
Below dam	1.77	1,003	1,554	1,809	2,313
Above Burnsides Pond	0.96	518	763	882	1,124
TRIBUTARY RP-1					
At mouth	2.08	1,040	1,700	1,990	2,880
At Seaboard Coastline	1.03	922	1,296	1,511	1,923

[1]Outside Richland County

TABLE 1 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
TRIBUTARY RP-1 (continued)					
Approximately 2,800 feet downstream of Britton Road	0.72	708	995	1,160	1,476
At U. S. Routes 76 and 378	0.37	530	880	1,040	1,410
SMITH BRANCH					
At mouth	7.36	2,681	3,867	4,435	5,672
At confluence of Bay Branch	5.35	2,286	3,297	3,781	4,836
Above confluence of Bay Branch	2.36	1,727	2,590	2,994	3,973
At Colonial Drive	1.91	1,399	2,129	2,494	3,407
BAY BRANCH					
At mouth	2.99	1,615	2,398	2,790	3,720
At Lorick Avenue	2.58	1,500	2,228	2,592	3,456
At Farrow Road	1.60	1,159	1,856	2,204	3,072
RAWLS CREEK					
At Town of Irmo southwest corporate limits	3.20	1,540	2,380	2,720	3,840
Upstream of confluence of Tributary R-2	1.90	1,080	1,730	2,010	2,870
Approximately 1,700 feet upstream of county boundary	0.92	650	1,020	1,185	1,470
TRIBUTARY R-2					
At mouth	1.2	820	1,340	1,580	2,250

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the FIRM (Exhibit 2).

Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals.

Along certain portions of streams, a profile base line is shown on the maps to represent channel distances as indicated on the flood profiles and floodway data tables.

All elevations are referenced to the NGVD. Elevation reference marks used in this study, and their descriptions, are shown on the maps.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

Precountywide Analyses

Each community within Richland County had a previously printed FIS report describing that community's hydraulic analyses. Those analyses not revised in the January 19, 1994, countywide FIS have been compiled from the FIS reports and are summarized below.

For the unincorporated areas of Richland County, Cities of Columbia and Forest Acres, and the Towns of Arcadia Lakes and Irmo, cross sections and structural information used in the hydraulic analyses were obtained by field surveys and from topographic maps at a scale of 1"=200' with a contour interval of 5 feet (Reference 23). For the Town of Eastover, cross sections for the backwater analysis were field surveyed or synthesized where hydraulically necessary, using adjacent survey cross sections and topographic maps (Reference 15). All bridges, culverts and dams were field checked to obtain elevation data and structural geometry.

For the Town of Irmo FIS dated April 16, 1991, cross sections for Rawls Creek upstream of the confluence of Tributary R-2 were determined from field surveys and from detailed topographic mapping (Reference 24).

Within the unincorporated areas of Richland County, the Cities of Columbia and Forest Acres, and the Towns of Arcadia Lakes and Irmo, water-surface elevations for floods of the selected recurrence intervals were computed using the USACE HEC-2 step-backwater computer program (Reference 25). Water-surface elevations on Gills, Jackson, and Little Jackson Creeks were also computed using the HEC-1 Dam Break Program (Reference 11). The HEC-1 model was used to route the various floods through the reservoirs and determine the amount of overtopping that would occur at each structure. Criteria outlined by the USACE in a meeting entitled "Evacuation Plans Corps of Engineers Dams" were used to determine the amount of overtopping necessary to cause failure, and the size and shape of the breach (Reference 26).

For the unincorporated areas of Richland County, the Cities of Columbia and Forest Acres, and the Town of Arcadia Lakes, the criteria were verified by an actual breach that occurred at Forest Lake Dam on Gills Creek during the flood of September 1945. The HEC-1 model determined the amount and duration of overtopping for each flood and automatically breached the structure if the overtopping limit was exceeded. The overtopping limit varied between 2 and 4 feet depending upon the type of structure. The HEC-1 model also computed the peak outflow below the dam which was inserted into the HEC-2 model to determine flood elevations in reaches below the dams. The hydraulic analyses for other streams in the study area did not involve dam break analyses and were therefore based entirely on the HEC-2 step backwater method of calculation.

For the unincorporated areas of Richland County and the City of Columbia, the acceptability of assumed hydraulic factors, cross sections, and hydraulic structural data was checked by computations which duplicated historic flood data on streams for which historic information was available. On streams for which no records or historic data could be found, news articles and interviews with local residents helped establish locations where damages have occurred during past floods. When compared with this information the computed flood elevations appeared to be reasonable.

For the Town of Arcadia Lakes and City of Forest Acres, there were no high water marks or gage records which could be used to verify the Jackson Creek hydraulic model. However, interviews with local residents indicated that Carys Lake Dam was overtopped and partially breached during the flood of August 1940 and interviews helped establish locations where damages have occurred during past floods. Based on the period of record, the 1940 flood was probably in the 25- to 50-year frequency range. This information verifies the computed 50-year flood which, according to rationale adopted for the Town of Arcadia, will also overtop the dam.

For the Town of Eastover, water-surface elevations for stream channels and bridges were computed using WSPRO, a step-backwater computer program (Reference 27). Water-surface elevations upstream of culverts were computed using the USGS program A526 (Reference 28).

Starting water-surface elevations for HEC-2 computations for all detailed streams except for Rawls Creek and Tributary R-2 were established using the slope/area method.

In the Town of Irmo, starting water-surface elevations for Rawls Creek were obtained from hydraulic studies conducted on the lower reaches of this stream. These studies were included in a Flood Insurance Report covering the unincorporated areas of Lexington County (Reference 29). Starting water-surface elevations for Tributary R-2 were obtained from the Rawls Creek profile.

For the flooding sources studied by approximate methods in the Town of Irmo, the 100-year water-surface elevations were determined using normal depth calculations.

Revised Analyses for the January 19, 1994, Countywide FIS

For the unincorporated areas of Richland County and City of Columbia, cross sections and structural information used in the hydraulic analyses were obtained by field surveys, photogrammetric methods, and information obtained from topographic maps at a scale of 1"=200' with a contour interval of 5 feet (Reference 23).

Within the unincorporated areas of Richland County and the City of Columbia, water-surface elevations for the following streams were computed using the HEC-2 step-backwater computer program and the HEC-1 Dam Break Program (References 25 and 11): Gills Creek, Crane Creek, Stoop Creek, Nicholas Creek, Swygert Branch, Moccasin Branch, North Branch Crane Creek, Beasley Creek, Cumbess Creek, Roberts Branch, Tributary RB-1, Sorghum Branch, Spears Creek, Tributary SP-1, Sandy Branch, Bridge Creek, Rice Creek, Reeder Point Branch, Tributary RP-1, Smith Branch, and Bay Branch. The HEC-2 model was first used to developed elevation-discharge ratings for dams and other hydraulic structures. The HEC-1 model was used to route the various floods through the reservoirs and determine the amount of overtopping that would occur at each structure. Criteria contained in Reference 26 were used to determine the amount of overtopping necessary to cause failure and the size and shape of the breach.

Starting water-surface elevations for new and revised streams were determined using the slope/area method.

Channel roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field observations of the streams and floodplain areas. Table 2, "Summary of Roughness Coefficients," shows the ranges of the channel and overbank roughness factors used in the hydraulic computations.

TABLE 2 - SUMMARY OF ROUGHNESS COEFFICIENTS

COMMUNITY	OVERBANK "n"	CHANNEL "n"
Town of Arcadia Lakes	0.040-0.080	0.020-0.040
City of Columbia	0.050-0.150	0.030-0.110
Town of Eastover	0.180-0.200	0.045-0.060
City of Forest Acres	0.050-0.150	0.015-0.100
Town of Irmo	0.040-0.080	0.050-0.080
Richland County (Unincorporated Areas)	0.050-0.150	0.015-0.120

For the Town of Eastover, channel roughness factors were chosen by engineering judgment and based on field observations of cross-sectional areas.

For the Town of Irmo, channel roughness factors were based on information obtained from aerial photographs and field observations of the streams and floodplain areas.

For the Cities of Forest Acres and Columbia and the Town of Arcadia Lakes, channel roughness factors were also based on information obtained from aerial photographs. For the unincorporated areas of Richland County, channel roughness factors were based on existing floodplain conditions.

This Revision

The channel roughness factors for the Congaree River ranged from 0.028 to 0.095 for the channel and from 0.030 to 0.200 for the overbanks. The channel roughness factors for Spears Creek ranged from 0.030 to 0.130 and from 0.070 to 0.180 for the overbanks.

Water-surface elevations of floods of the selected recurrence intervals were computed using the USACE HEC-2 step-backwater computer program (Reference 25). Starting water-surface elevations were calculated using the slope/area method.

It was determined that the levee along the east bank of the Congaree River would affect the flood hazard potential of this area of the county. Therefore, two analyses were computed for this stretch of the Congaree River, one with the levee and one without the levee. The first analysis represents a 100-year elevation on the waterward side of the levee should the levee remain intact. The second analysis represents flood conditions should the levee fail to provide protection against a 100-year event.

The floodway was computed assuming that the levee fails. The Floodway Data table for this area shows regulatory elevations for both the with and without levee scenarios. However, the “With Floodway” and “Without Floodway” elevations are based solely on the without levee scenario for the entire length of the Congaree River.

The topography of the Congaree River channel and the left overbank changes significantly approximately one mile downstream of the City of Columbia. The Congaree River channel becomes shallower with its flood conveyance considerably reduced compared to the channel upstream. The left overbank floodplain is relatively flat without high grounds to contain the flood waters of the Congaree River. The technique used to approximate this flow situation was to assume that the effective one-dimensional overbank flow exists only along a portion of the floodplain available on the left overbank. Flow expansions have been observed to happen at angles of 14 to 20 degrees from the main direction of flow. Effective flow areas in the vicinity of flow expansions and in the vicinity of I-77 road bridge were defined using two-dimensional flow analyses and this assumption.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each FIS generally provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For the streams studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. In the Town of Eastover, the boundaries were interpolated using topographic maps at a scale of 1:24,000 with a contour interval of 10 feet (Reference 15). In the unincorporated areas of Richland County, the Towns of Arcadia Lakes and Irmo, and the Cities of Columbia and Forest Acres, the boundaries were interpolated using topographic maps at scales of 1"=200' and 1:600 with contour intervals of 5 feet and 1 foot, respectively (References 23 and 24).

For the streams studied by approximate methods in the Town of Eastover, the boundaries of the 100-year floodplain were delineated using the Flood Hazard Boundary Map for the Town of Eastover (Reference 30). In the Towns of Arcadia Lakes, the boundaries of the 100-year floodplain for the streams studied by approximate methods were developed from normal depth calculations and topographic maps (Reference 23). For the flooding sources studied by approximate methods in the unincorporated areas of Richland County and the Cities of Columbia and Forest Acres, the 100-year floodplain boundaries were delineated using the previously printed Flood Insurance Studies for the unincorporated areas of Richland County and the Cities of Columbia and Forest Acres (References 31, 18, and 32). For the streams studied by approximate methods in the Town of Irmo, the 100-year floodplain boundaries were delineated using topgraphic maps (Reference 23).

The 100- and 500-year floodplain boundaries are shown on the FIRM (Exhibit 2). On this map, the 100-year floodplain boundaries correspond to the boundaries of the areas of special flood hazard (Zones A, AH, AO, and AE), and the 500-year floodplain boundaries correspond to the boundaries of areas of moderate flood hazard. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundaries have been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year floodplain boundaries are shown on the FIRM (Exhibit 2).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in floodheights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as a minimum standard that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study was computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections (Table 3). The computed floodway is shown on the FIRM (Exhibit 2). In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

A majority of the floodplain of Rocky Branch within the Columbia corporate limits is almost totally developed with permanent commercial buildings and facilities within the University of South Carolina campus. Since there is very little room in the floodplain for additional development which would increase flood hazards, it was decided that application of the floodway concept in certain areas would be impractical.

Because of the probability of dam failure discussed in Section 3.2, all property within the 100-year floodplain along Gills Creek below Forest Lake Dam and Lake Katherine Dam should be considered an area of high flood damage potential. Normally, development in floodway fringe areas would be elevated on piers or landfill above the 100-year flood elevation. This type of construction would not withstand the water velocities which could be generated by a dam failure. It was therefore decided that normal floodway criteria should not be applied in this situation.

A portion of the Gills Creek study reach includes Lake Katherine. For practical purposes, it was felt that the floodway boundary along this reach should be the lake shore. Normal lake elevation is controlled by two drop inlet spillways and a concrete ogee spillway which can be adjusted by addition of flash boards. The top of the concrete ogee spillway is 152.0 feet NGVD. Based on an assessment of existing and past conditions, it was assumed that 152.0 feet NGVD is the normal lake shore elevation and should be used to establish the floodway boundary.

In order to avoid future reduction of flood storage area which would increase the flood damage potential to Lake Katherine Dam, and the reach downstream from the dam, it is recommended that no landfill be allowed between the 100-year flood boundary and the lake shore.

Homes and other structures located in this area could be elevated on piers or pilings to achieve the required minimum first floor elevation. Table 3 lists floodway data which may be helpful in administering regulatory measures.

In the past, the spillways, outlet structures and other features of some of the dams on Gills Creek, Jackson Creek, and Little Jackson Creek have been purposely altered or have changed as a result of damage or deterioration. This study reflects conditions that existed at the time field surveys were conducted (May-July 1978). Since most of these dams are privately owned, future changes which may affect hydraulic characteristics may occur or be made without notification to local or Federal agencies.

For Griffins Creek, no floodway was computed. Portions of the floodways for the Congaree River, Saluda River, Rawls Creek, and Spears Creek extend beyond the county boundary.

Encroachment into areas subject to inundation by floodwaters having hazardous velocities aggravates the risk of flood damage, and heightens potential flood hazards by further increasing velocities. A listing of stream velocities at selected cross sections is provided in Table 3, "Floodway Data." In order to reduce the risk of property damage in areas where the stream velocities are high, the community may wish to restrict development in areas outside the floodway.

Near the mouths of streams studied in detail, floodway computations are made without regard to flood elevations on the receiving water body. Therefore, "Without Floodway" elevations presented in Table 3 for certain downstream cross sections of Gills Creek, Tributary G-1, Eightmile Branch, Little Jackson Creek, Rocky Branch, Wildcat Creek, Pen Branch, Crane Creek, Nicholas Creek, Swygert Branch, Cumbess Creek, Tributary SP-1, Reeder Point Branch, Smith Branch, and Bay Branch are lower than the regulatory flood elevations in that area, which must take into account the 100-year flooding due to backwater from other sources.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 1.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY[8]	WITH FLOODWAY[8]	INCREASE
Congaree River								
A	226.700	15.299	142.884	2.1	132.6/131.8[6]	131.8	132.5	0.7
B	234.100	17.106	149.962	2.0	135.3/133.9[6]	133.9	134.6	0.7
C	246.700	10.240[3]	133.962	2.2	139.9/137.4[6]	137.4	138.3	0.9
D	249.300	9.775[3]	111.152	2.7	141.7/138.1[6]	138.1	139.0	0.9
E	253.400	4.372	42.830	7.0	142.8/139.2[6]	139.2	140.2	1.0
F	256.100	626	22.108	13.5	145.7[7]	142.6	143.2	0.6
G	258.400	602	21.580	13.8	146.9[7]	144.5	145.1	0.6
H	260.400	1.148[4]	37.376	8.0	150.5[7]	148.7	149.1	0.4
I	261.200	1.314	43.450	6.9	151.7[7]	150.1	150.4	0.3
J	262.900	1.391	41.953	7.1	151.9[7]	150.4	150.8	0.4
K	264.500	1.470	43.655	6.8	152.4[7]	151.0	151.4	0.4
L	265.200	1.090	35.724	8.4	152.5[7]	151.1	151.3	0.2
M	266.900	810	30.955	9.4	152.6[7]	151.2	151.6	0.4
N	267.750	1.050	34.750	8.4	153.2[7]	151.9	152.4	0.5
O	267.850	1.437	48.866	6.0	153.2[7]	151.9	152.4	0.5
P	268.920	1.649	48.503	6.0	153.9[7]	152.7	153.2	0.5
Q	269.250	1.648	45.308	6.4	154.0[7]	152.7	153.2	0.5
R	270.450	2.294	51.343	5.7	154.3[7]	153.1	153.7	0.6
S	272.010	2.293[5]	53.644	5.4	154.7[7]	153.6	154.1	0.5

[1]Feet above mouth
[2]Width extends beyond county boundary
[3]Combined Congaree River/Congaree Creek floodway
[4]Combined Congaree River/Rocky Branch floodway
[5]Combined Saluda, Broad, and Congaree River floodway
[6]Water-surface elevation with levee/water-surface elevations without levee
[7]Water-surface elevation with levee
[8]Elevation computed without consideration of the hydraulic effects of the levee

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, SC AND INCORPORATED AREAS

FLOODWAY DATA

CONGAREE RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Saluda River								
A	3.300	800	6.149	17.1	154.8	144.5[3]	144.5	0.0
B	5.000	530	10.072	10.4	156.2	156.2	156.7	0.5
C	7.100	726	15.662	6.7	160.3	160.3	160.8	0.5
D	10.870	617	9.232	11.4	168.5	168.5	169.0	0.5
E	13.600	841	14.951	7.0	175.1	175.1	175.9	0.8
F	15.300	1.174	16.692	6.3	177.3	177.3	178.0	0.7
G	17.000	805	14.345	7.3	178.9	178.9	179.5	0.6

[1]Feet above confluence with Congaree River
[2]Width extends beyond county boundary
[3]Elevation computed without consideration of backwater effects from Congaree River

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, SC
AND INCORPORATED AREAS

FLOODWAY DATA

SALUDA RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Broad River								
A	3.000	1.900	38.309	7.8	159.9	159.9	160.7	0.8
B	4.600	1.210	24.613	12.1	160.3	160.3	161.3	1.0
C	8.500	1.100	25.630	11.6	166.3	166.3	166.7	0.4
D	9.500	1.045	22.680	13.1	167.4	167.4	168.3	0.9
E	14.800	1.525	35.321	11.8	175.1	175.1	175.9	0.8
F	17.100	1.380	40.041	7.0	177.8	177.8	178.5	0.7
G	17.500	1.370	40.190	7.0	177.9	177.9	178.6	0.7
H	18.200	1.350	75.553	3.7	178.7	178.7	179.3	0.6
I	22.050	2.350	55.713	5.0	179.5	179.5	180.1	0.6
J	23.500	2.070	40.652	6.9	179.9	179.9	180.6	0.7
K	27.100	1.650	40.983	6.9	182.1	182.1	183.0	0.9
L	29.200	1.660	46.982	6.0	183.6	183.6	184.5	0.9
M	35.840	2.260	51.688	5.4	186.1	186.1	187.0	0.9
Mill Creek								
A	91.000	880	11.409	0.2	138.5	138.5	138.5	0.0
B	93.450	485	2.779	0.7	138.5	138.5	138.5	0.0
C	99.300	740	2.259	0.9	149.0	149.0	149.9	0.9
D	101.200	675	1.396	1.4	157.2	157.2	158.1	0.9
E	102.000	400	5.998	0.3	170.4	170.4	170.5	0.1
F	103.250	400	4.239	0.5	170.4	170.4	170.6	0.2
G	105.350	400	2.067	1.4	170.6	170.6	171.2	0.6
H	107.250	395	2.652	1.1	177.3	177.3	178.1	0.8
I	108.250	400	7.246	0.8	194.2	194.2	195.0	0.8

[1]Feet above mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, SC AND INCORPORATED AREAS

FLOODWAY DATA

BROAD RIVER - MILL CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Rocky Branch								
A	1.800	140	1.411	2.5	149.1	133.9[2]	134.9	1.0
B	3.000	225	461	7.7	149.1	139.8[2]	140.8	1.0
C	3.400	145	1.002	3.5	149.1	146.4	146.5	0.1
D	4.100	140	1.221	2.9	149.9	149.9	150.8	0.9
E	5.000	120	1.082	3.3	153.9	153.9	154.8	0.9
F-M*								
Tributary C-2								
A	2.130	295	2.414	1.1	188.4	188.4	188.4	0.0
B	2.565	245	1.285	2.1	188.5	188.5	188.6	0.1
C	2.850	180	678	3.5	189.2	189.2	189.6	0.4
D	3.000	220	718	3.3	203.0	203.0	204.0	1.0
E	3.650	95	572	4.1	207.0	207.0	207.8	0.8
F	4.830	145	705	3.3	216.0	216.0	216.6	0.6
G	5.800	110	518	3.9	223.0	223.0	224.0	1.0
H	6.620	90	423	4.7	233.1	233.1	233.6	0.5
I	6.830	110	539	3.7	235.9	235.9	236.7	0.8
J	7.400	70	385	5.2	243.0	243.0	243.6	0.6
K	7.935	85	477	4.2	250.3	250.3	250.9	0.6
L	8.650	75	308	5.0	257.5	257.5	258.5	1.0

[1]Feet above mouth
[2]Elevation computed without consideration of backwater effects from the Congaree River
*No floodway data computed

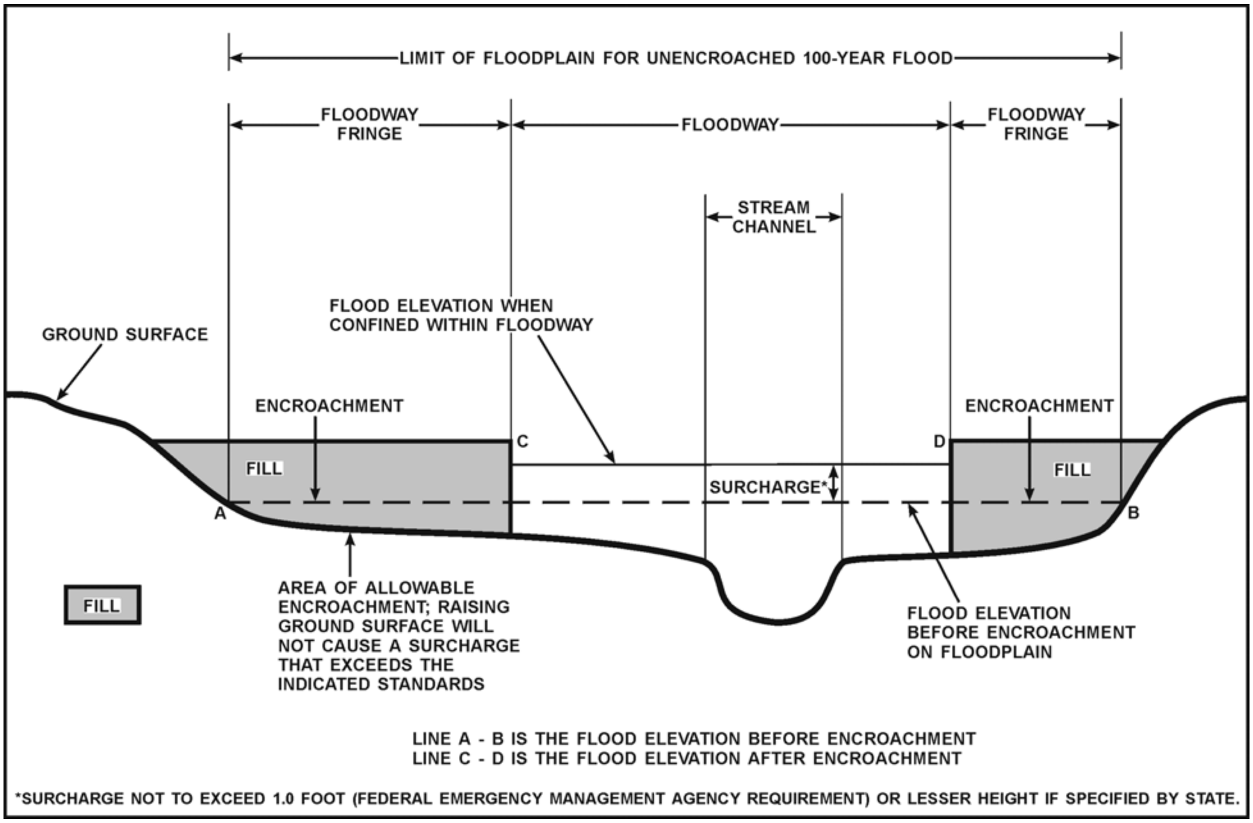
TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, SC AND INCORPORATED AREAS

FLOODWAY DATA

ROCKY BRANCH - TRIBUTARY C-2



FLOODWAY SCHEMATIC Figure 1

5.0 INSURANCE APPLICATIONS

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. The zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the FIS by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the FIS by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-depths derived from the detailed hydraulic analyses are shown within this zone.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown within this zone.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no base flood elevations are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, and to areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

6.0 FLOOD INSURANCE RATE MAP

The FIRM is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 100- and 500-year floodplains. Floodways and the locations of selected cross sections used in the hydraulic analyses and floodway computations are shown where applicable.

The countywide FIRM presents flooding information for the entire geographic area of Richland County. Previously, separate Flood Hazard Boundary Maps and/or FIRMs were prepared for each identified flood-prone incorporated community and the unincorporated areas of the county. This countywide FIRM also includes flood hazard information that was presented separately on Flood Boundary and Floodway Maps, where applicable. Historical data relating to the maps prepared for each community up to and including the January 19, 1994, countywide FIS is presented in Table 4, "Community Map History."

7.0 OTHER STUDIES

This is a multivolume FIS. Each volume may be revised separately, in which case it supersedes the previously printed volume. Users should refer to the Table of Contents in Volume 1 for the current effective date of each volume; volumes bearing these dates contain the most up-to-date flood hazard data.

FISs have been prepared for Lexington County, South Carolina, and Incorporated Areas, and the unincorporated areas of Kershaw County, New Bongo County, Fairfield County, and Sumter County (References 1, 33, 34, 35, and 36). An FIS is currently being prepared for Kershaw County, South Carolina, and Incorporated Areas (Reference 37).

Because it is based on more up-to-date analyses, this FIS supersedes the previously printed countywide FIS for Richland County, South Carolina, and Incorporated Areas (Reference 38).

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Arcadia Lakes, Town of	August 2, 1974	June 4, 1976 October 22, 1976	November 19, 1980	January 19, 1994
Columbia, City of	June 28, 1974	October 22, 1976	September 2, 1981	September 1, 1983 February 4, 1987 January 19, 1994
Eastover, Town of	May 31, 1974	August 30, 1976	September 30, 1988	January 19, 1994
Forest Acres, City of	June 7, 1974	September 26, 1975	November 5, 1980	March 25, 1983 November 20, 1991 January 19, 1994
Irmo, Town of [1]	May 17, 1974	April 30, 1976 January 13, 1978	May 1, 1980	January 3, 1985 April 16, 1991
Unincorporated Areas	July 29, 1977	May 12, 1978	November 4, 1981	January 3, 1985 April 17, 1987 December 5, 1989 January 19, 1994

[1]This community was not part of the January 19, 1994, countywide FIS. It became a part of the countywide FIS in the July 17, 1995, revision.

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, SC AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting FEMA, Mitigation Division, Koger Center - Rutgers Building, 3003 Chamblee Tucker Road, Atlanta, Georgia 30341.

9.0 BIBLIOGRAPHY AND REFERENCES

1. Federal Emergency Management Agency, Flood Insurance Study, Lexington County, South Carolina, and Incorporated Areas, Washington, D.C., July 17, 1995 (currently being revised).

2. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Environmental Data Service, Monthly Averages of Temperature and Precipitation for State Climatic Division 1941-1970: South Carolina, National Climatic Center, Asheville, North Carolina, August 1973.

3. U.S. Department of the Interior, Geological Survey, Water Supply Paper 1673, Magnitude and Frequency of Floods in the United States, Part 2-A.

4. Richland County Council, Subdivision Regulations, August 1971.

5. Leo R. Beard, Statistical Methods in Hydrology, Sacramento, California, U.S. Army Corps of Engineers, January 1962.

6. Water Resources Council, "Guidelines for Determining Flood Flow Frequency," Bulletin 17, Washington, D.C., March 1976.

7. Butler, Engineering Hydrology, 1957.

8. Ven Te Chow, ed., Handbook of Applied Hydrology, New York, McGraw-Hill, 1964.

9. Lyles, Bisset, Carlisle & Wolff, Hydrologic Engineering Report No. 1072.1, Congaree River near Columbia, South Carolina, October 1972.

10. U.S. Army Corps of Engineers, Charleston District, Design Memorandum No. 9, Cooper River Rediversion Project.

11. U.S. Army Corps of Engineers, HEC-1 Flood Hydrograph Package for Dam Safety Investigations, March 1987.

12. U.S. Army Corps of Engineers, EM 1110-2-1405, Flood Hydrograph Analyses and Computations, August 31, 1959.

13. U.S. Department of the Interior, Geological Survey, Raleigh, North Carolina, Effect of Urban Development on Floods in the Piedmont Province of North Carolina, Arthur L. Putnam, 1972.

14. U.S. Department of the Interior, Geological Survey, Water Resources Division, Report 82-1, Techniques for Estimating Magnitude and Frequency of Floods in South Carolina, B. H. Whetstone, 1982.

15. U.S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 10 Feet: Richland County, South Carolina, 1982.

16. U.S. Department of the Interior, Geological Survey, Water Resouces Investigations, Open File Report 88-4085, Flood-Frequency Relations for Urban Streams in Georgia, E.J. Inman, Doraville, Georgia, 1988.

17. U.S. Department of Agriculture, Soil Conservation Service, Technical Release No. 55, Urban Hydrology for Small Watersheds, Washington, D.C., June 1986.

18. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, City of Columbia, Richland County, South Carolina, Washington, D.C., February 4, 1987.

19. Federal Emergency Management Agency, Flood Insurance Study - Guidelines and Specifications for Study Contractors, Washington, D.C., January 1995.

20. U.S. Geological Survey, PEAKFQ 2.4, Reston, Virginia, April 1998.

21. Law Engineering Testing Company, Probable Maximum Flood Study-Lake Murray Watershed, Columbia, South Carolina, November 1984.

22. Law Engineering Testing Company, Probable Maximum Flood Study-Lake Murray Watershed-Addendum No. 1, Columbia, South Carolina, September 1985.

23. Central Midlands Regional Planning Council, Topographic Maps, Scale 1"=200', Contour Interval 5 Feet, February 1973.

24. Steven M. Bradley, "Untitled Work Map," Scale 1:600, Contour Interval 1 Foot: July 1989.

25. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Generalized Computer Program, Davis, California, May 1991.

26. Minutes and Summary of July 6, 1977 meeting in South Atlantic Division Office of the Corps of Engineers. Subject of Meeting: "Evacuation Plans Corps of Engineers Dams."

27. U.S. Department of Transportation, Federal Highway Administration, Report No. FHWA/RD-86/108, Bridge Waterways Analysis Model: Research Report, J.O. Shearman, W.H. Kirby, V.R. Snyder, and H.N. Flippo, July 1986.

28. U.S. Department of the Interior, Geological Survey, Water Resources Division, Preparation of Input Data for Automatic Computation of Stage-Discharge Relations at Culverts, H. F. Mathai, H. E. Stall, and J. Davidson, undated.

29. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, Unincorporated Areas of Lexington County, South Carolina, draft report prepared by the U.S. Army Corps of Engineers in August 1978.

30. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Town of Eastover, Richland County, South Carolina, August 30, 1976.

31. Federal Emergency Management Agency, Flood Insurance Study, Richland County, South Carolina (Unincorporated Areas), Washington, D.C., December 5, 1989.

32. Federal Emergency Management Agency, Flood Insurance Study, City of Forest Acres, Richland County, South Carolina, Washington, D. C., November 20, 1991.

33. Federal Emergency Management Agency, Flood Insurance Study, Kershaw County, South Carolina (Unincorporated Areas), Washington, D.C., November 2, 1983.

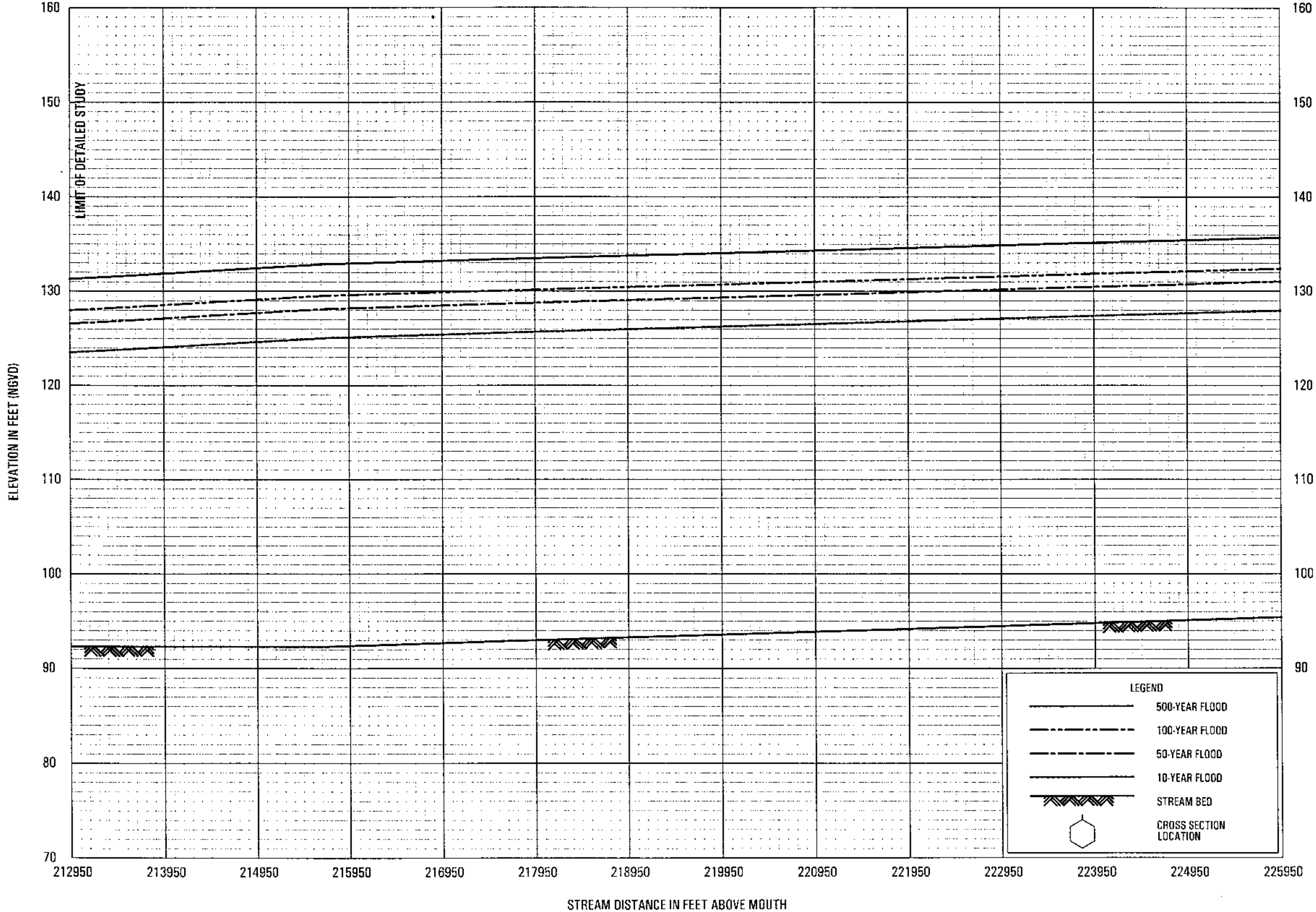
34. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, New Bongo County, South Carolina (Unincorporated Areas), Washington, D.C., September 29, 1978.

35. Federal Emergency Management Agency, Flood Insurance Study, Fairfield County, South Carolina (Unincorporated Areas), Washington, D.C., July 19, 1982.

36. Federal Emergency Management Agency, Flood Insurance Study, Sumter County, South Carolina (Unincorporated Areas), Washington, D.C., January 5, 1989.

37. Federal Emergency Management Agency, Flood Insurance Study, Richland County, South Carolina, and Incorporated Areas, Washington, D.C., January 17, 1997.

38. Federal Emergency Management Agency, Flood Insurance Study, Kershaw County, South Carolina and Incorporated Areas (Unpublished).



FLOOD PROFILES

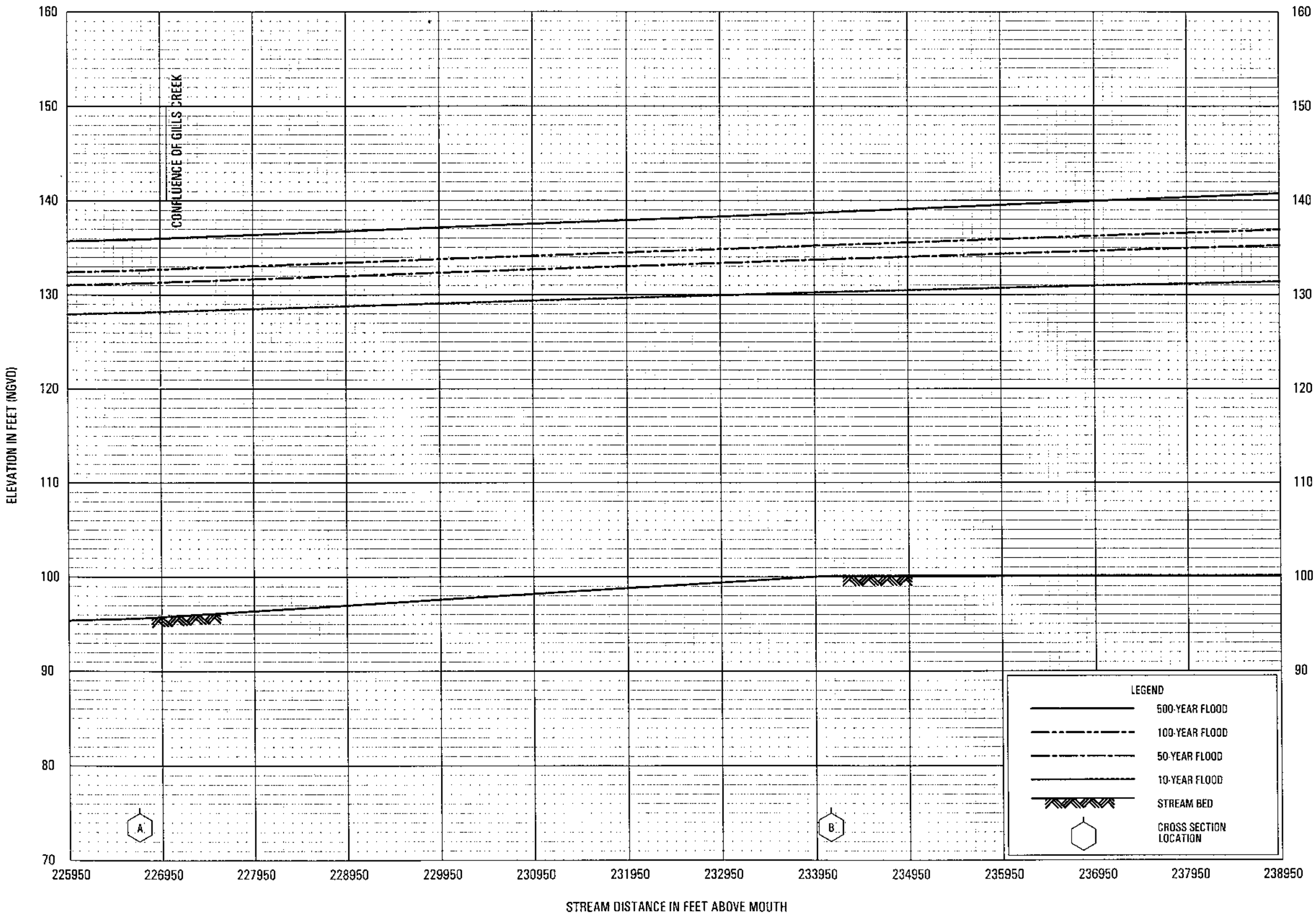
CONGAREE RIVER (WITH LEVEE)

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, SC

AND INCORPORATED AREAS

01P



FLOOD PROFILES

CONGAREE RIVER (WITH LEVEE)

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, SC

AND INCORPORATED AREAS

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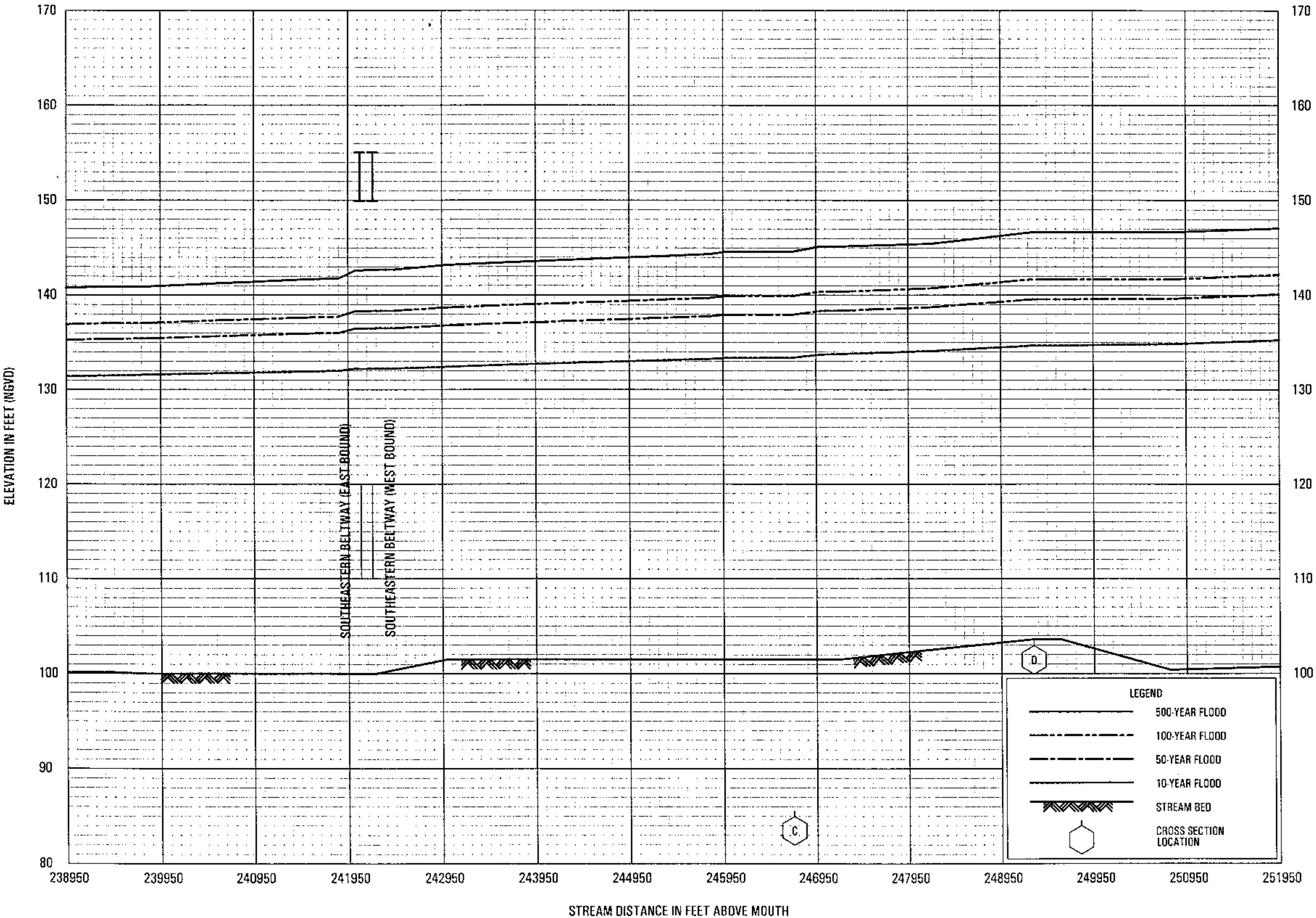

FLOOD PROFILES

CONGAREE RIVER (WITH LEVEE)

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, SC

AND INCORPORATED AREAS

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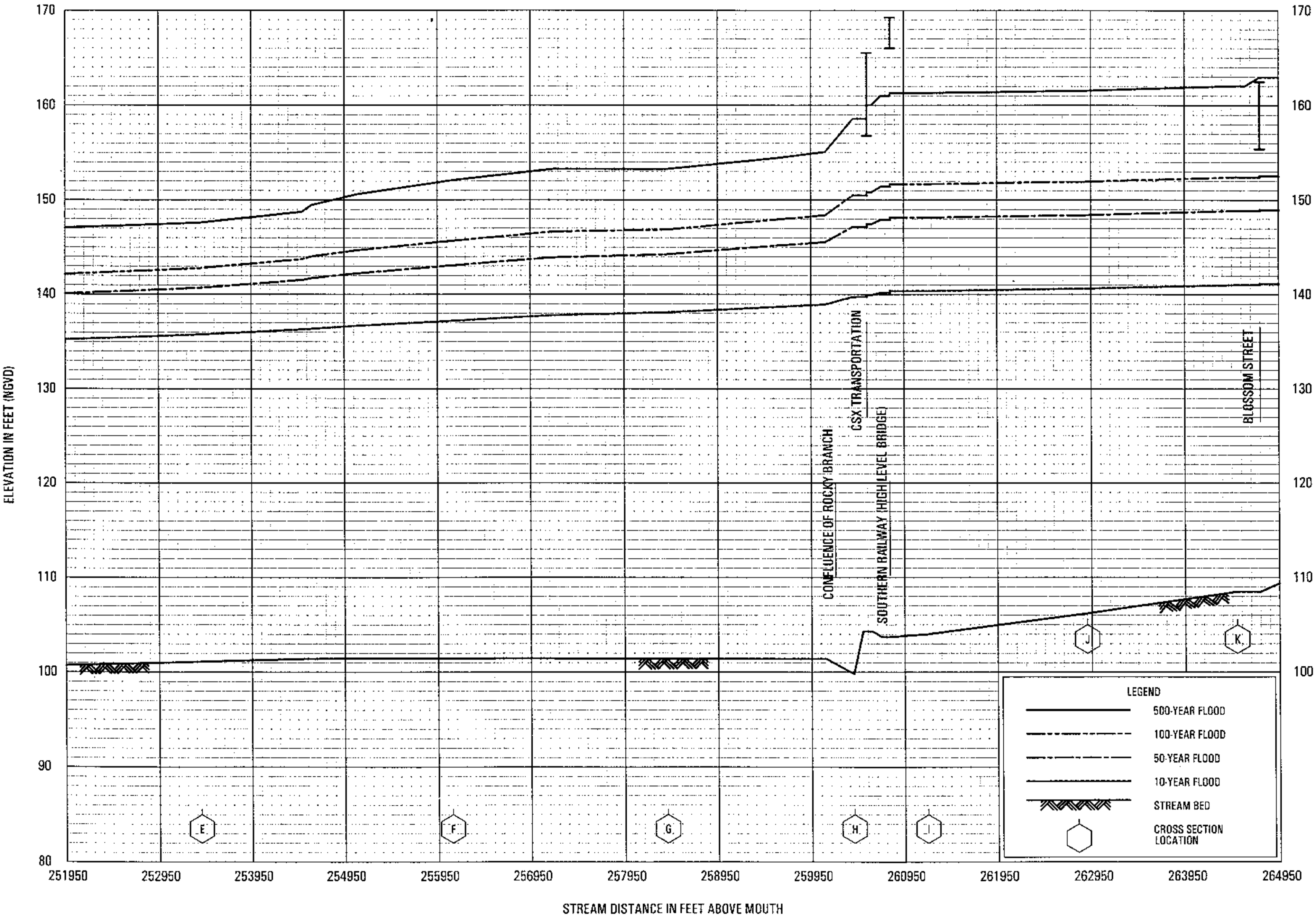

FLOOD PROFILES

CONGAREE RIVER (WITH LEVEE)

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, SC

AND INCORPORATED AREAS

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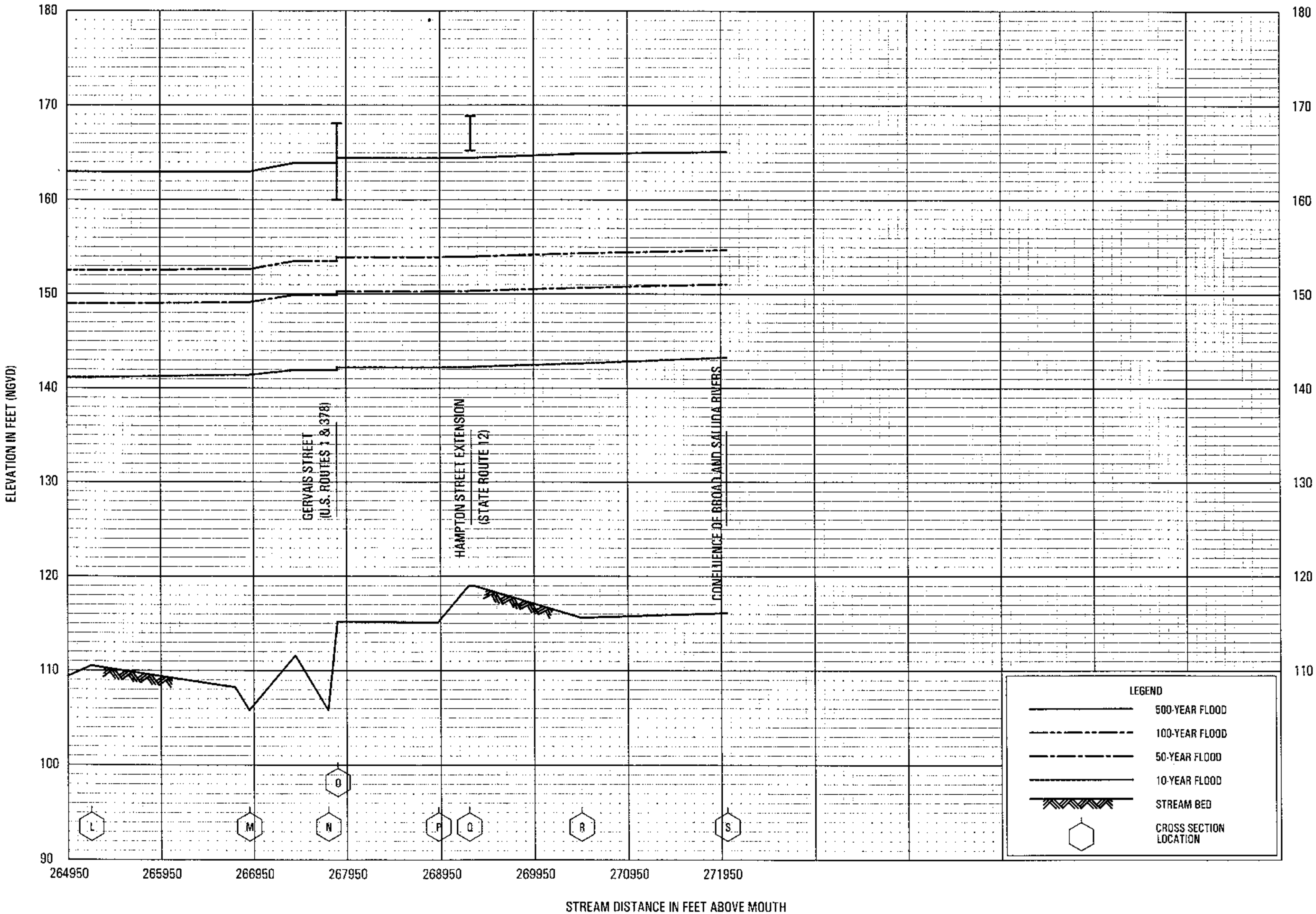


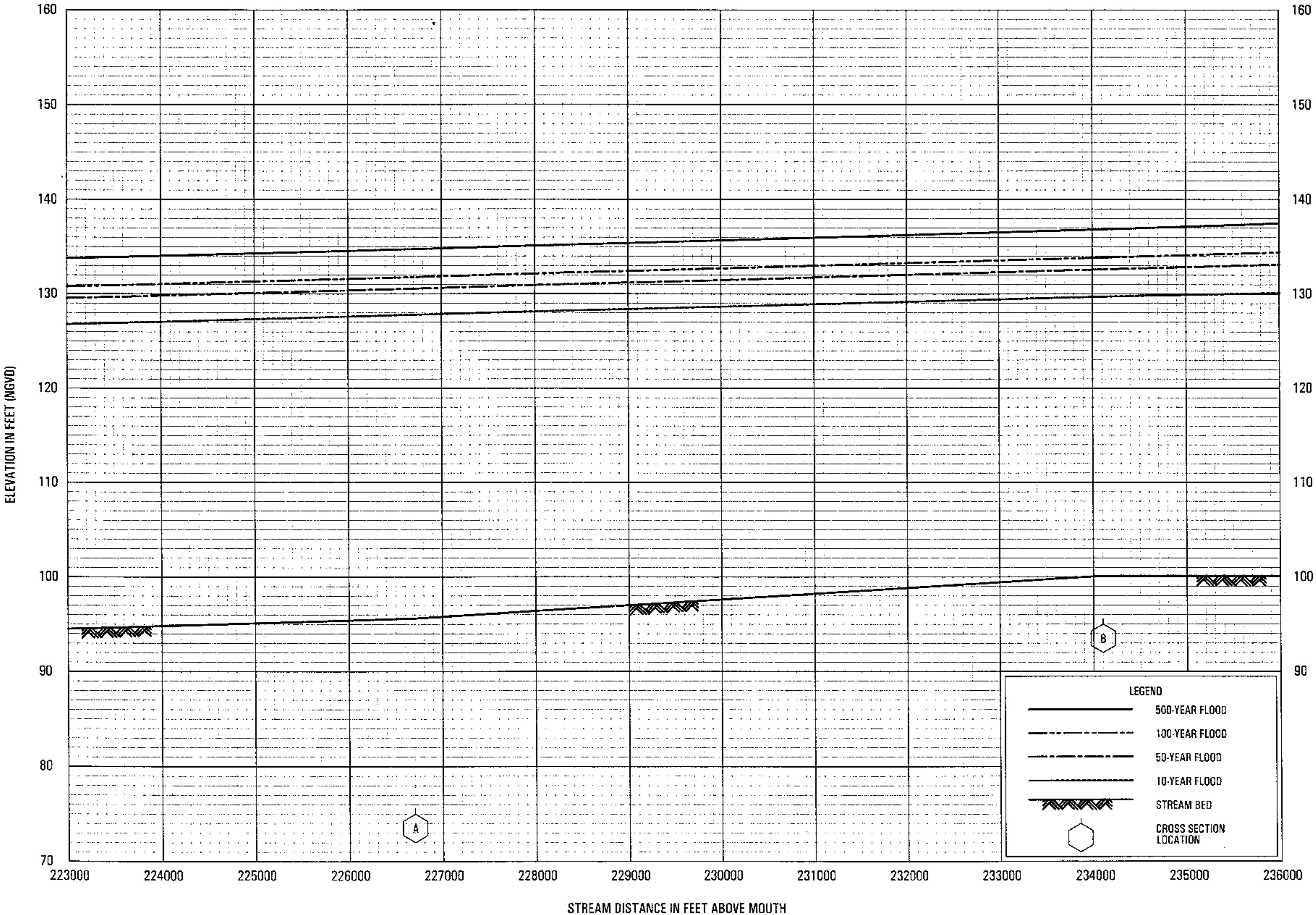
FLOOD PROFILES

CONGAREE RIVER (WITH LEVEE)

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, SC
AND INCORPORATED AREAS

05P



FLOOD PROFILES

CONGAREE RIVER (WITHOUT LEVEE)

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, SC
AND INCORPORATED AREAS

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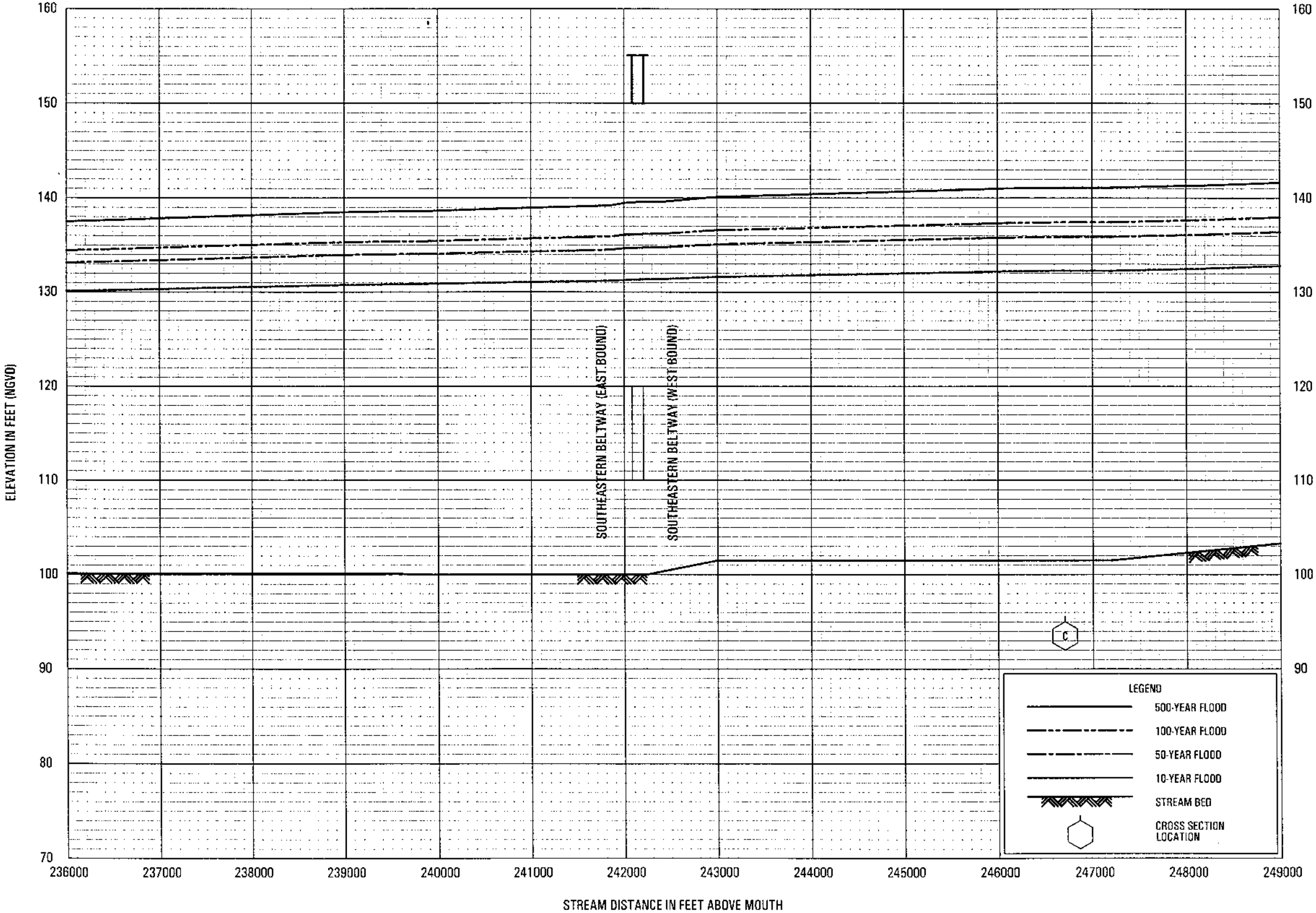


FLOOD PROFILES

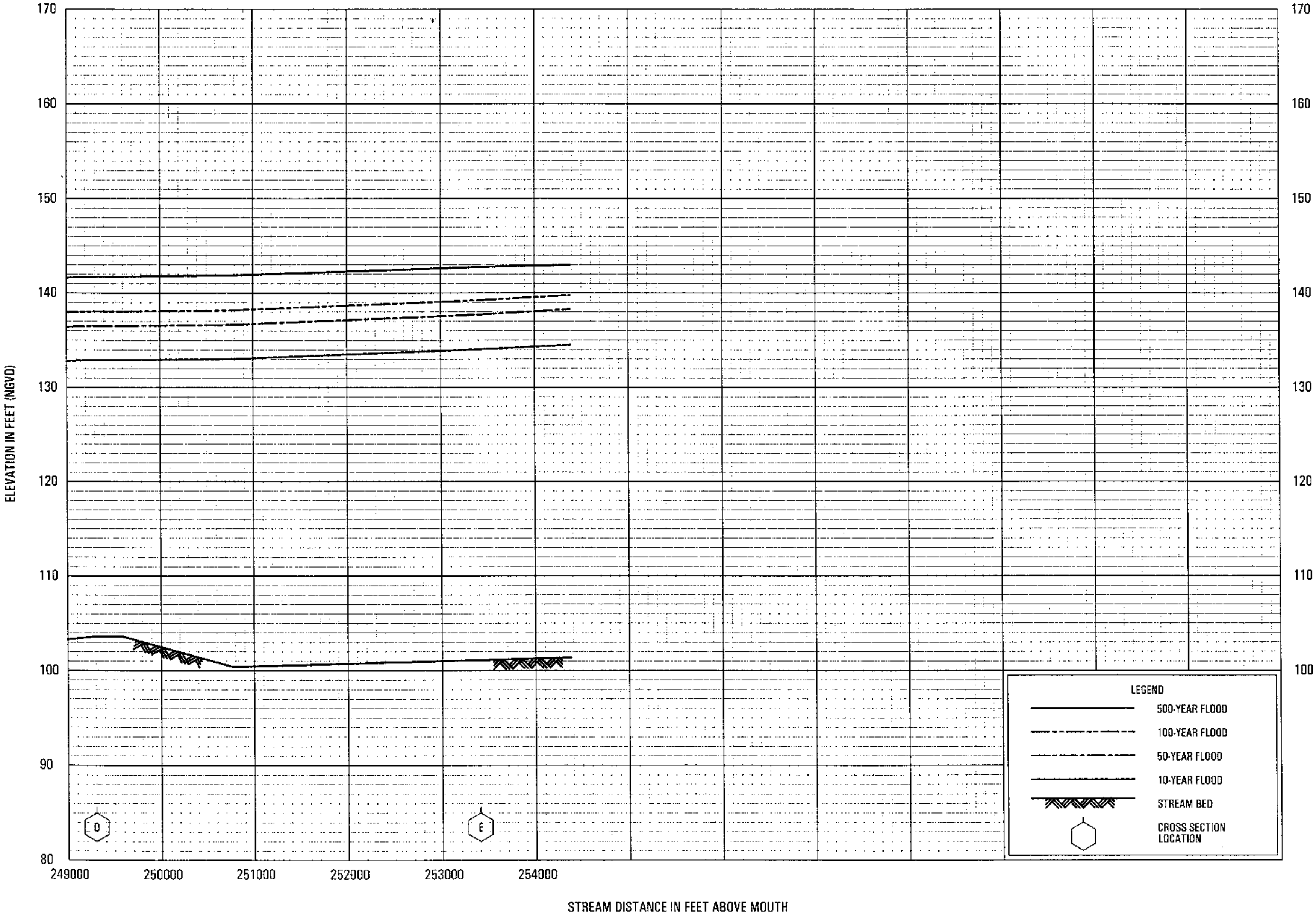
CONGAREE RIVER (WITHOUT LEVEE)

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, SC

AND INCORPORATED AREAS

05P(b)



FLOOD PROFILES

CONGAREE RIVER (WITHOUT LEVEE)

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, SC

AND INCORPORATED AREAS

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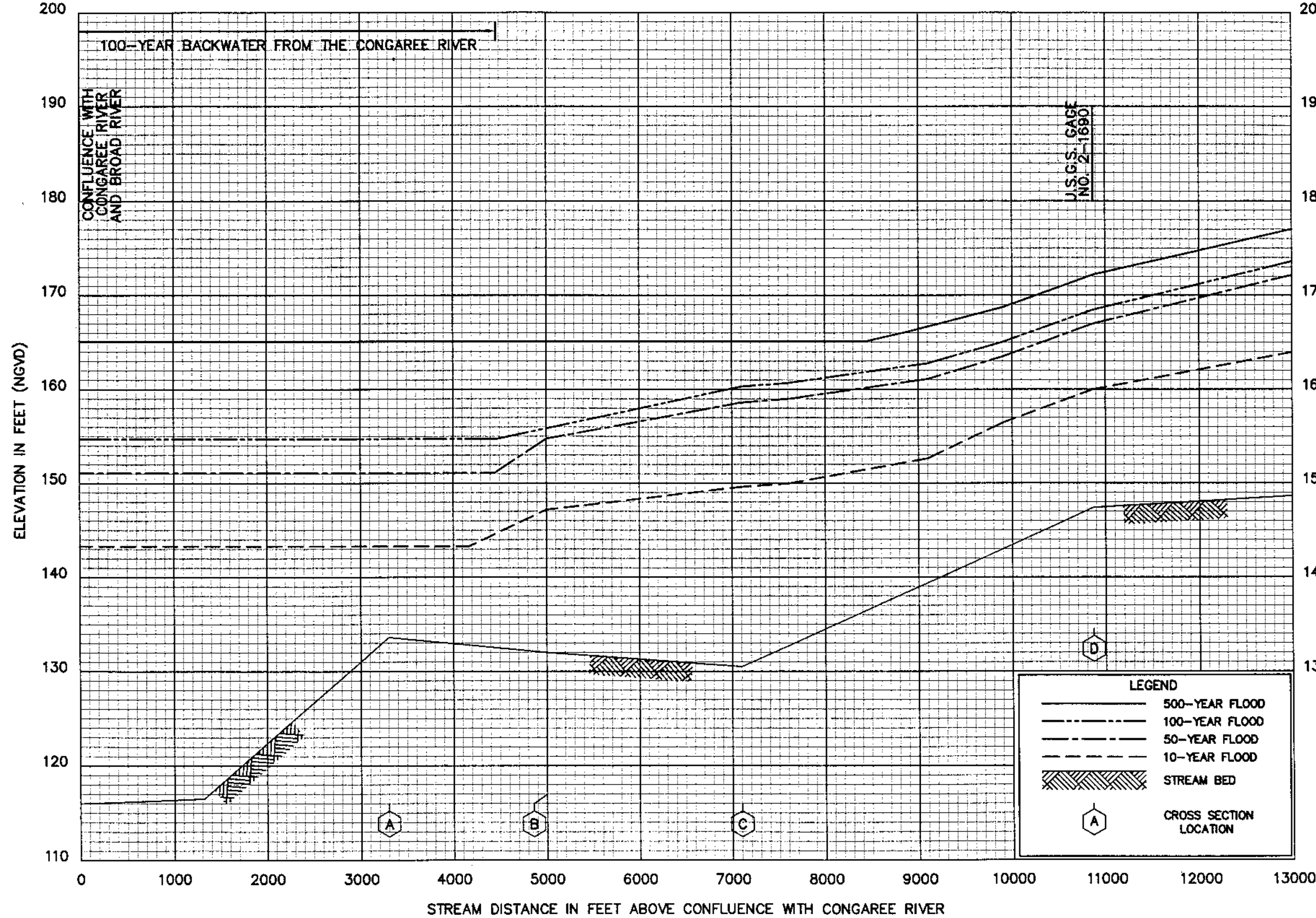

FLOOD PROFILES

SALUDA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, SC

AND INCORPORATED AREAS

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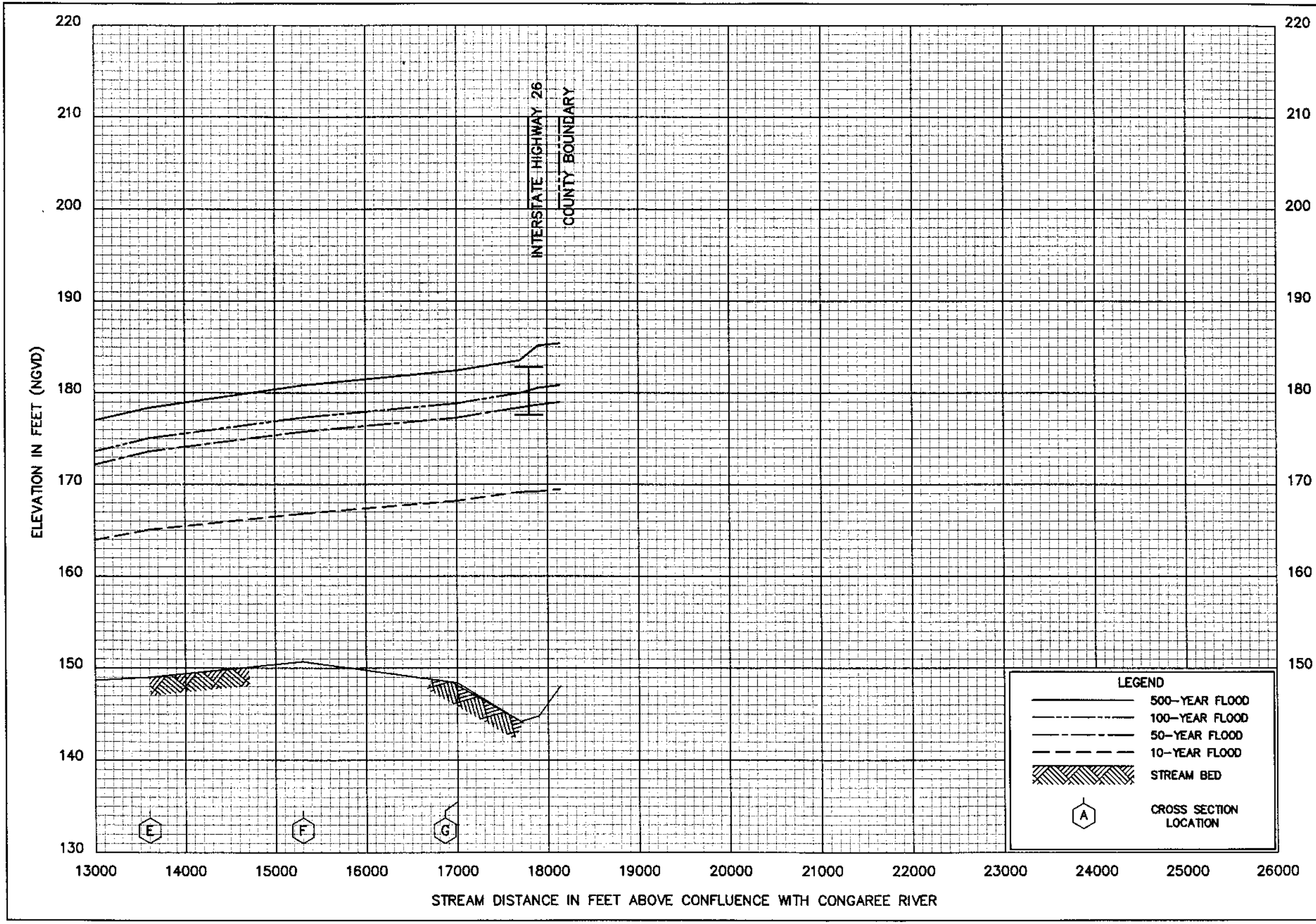


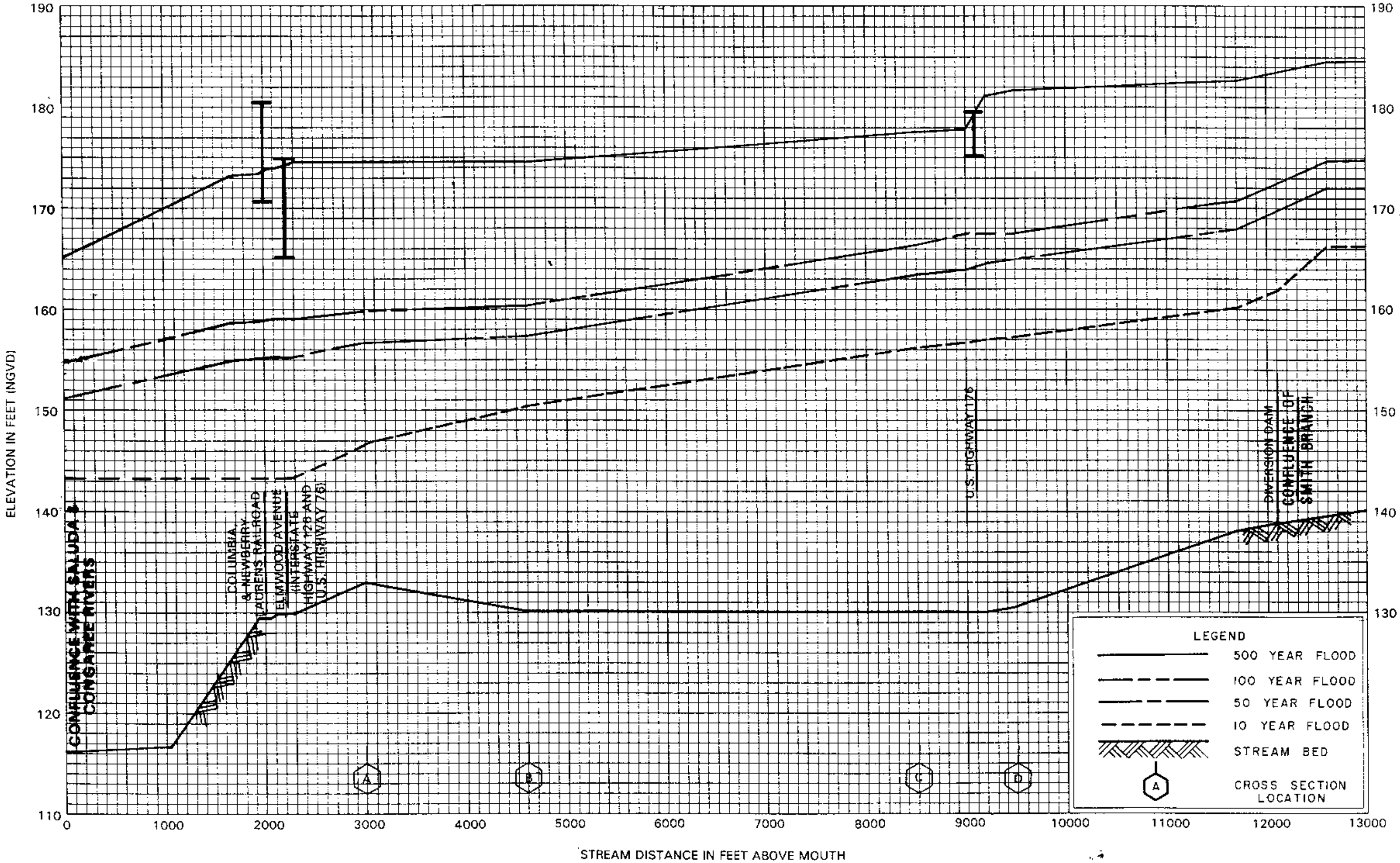
FLOOD PROFILES

SALUDA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, SC

AND INCORPORATED AREAS



FLOOD PROFILES

BROAD RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, SC AND INCORPORATED AREAS

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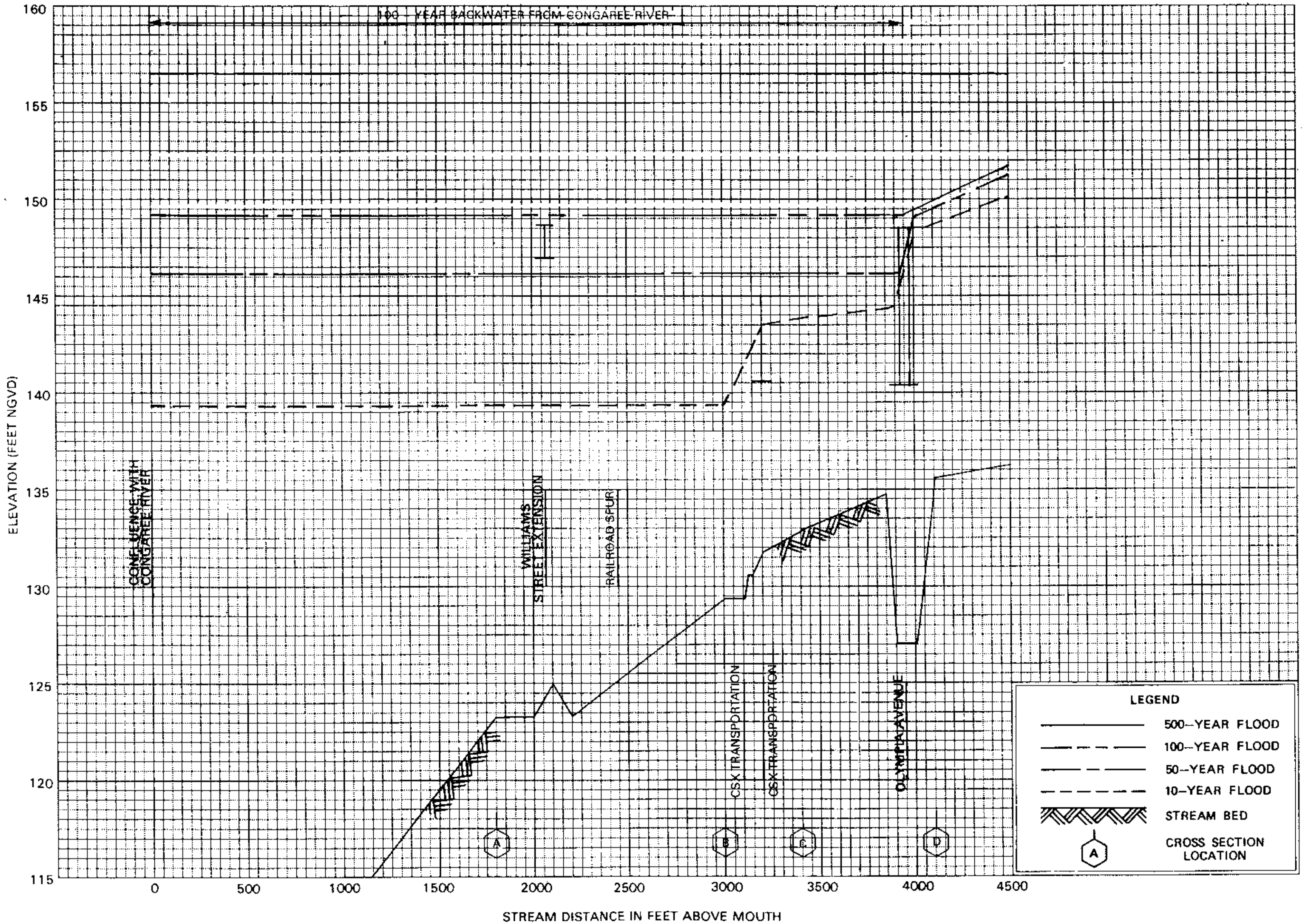

FLOOD PROFILES

ROCKY BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, SC AND INCORPORATED AREAS

44P

FLOOD PROFILES

ROCKY BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

RICHLAND COUNTY, SC AND INCORPORATED AREAS

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